THE FOUNDRY

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A Simple Testing Machine.

The necessity of having some medium whereby iron mixtures may be controlled and kept of a uniform quality is being recognized by every progressive founder. Demands are being made for castings that will come up to certain specifications, and the foundries that are capable of meeting these requirements are not only increasing their chances for securing such jobs, but, as a rule, the best paid work is found where the greatest exactness is insisted upon. From this it follows that there is a pecuniary gain in being able to afford customers a guarantee that castings shall contain the specified characteristics.

There are many ways of testing iron, from the simple but somewhat uncertain way of fastening a test bar in a vise and judging its strength by breaking it with a hammer, to the most costly machines which give results that approach perfection. Many foundries are testing iron in special contrivances of their own, and in some cases best suited to the peculiarities of the branch in which they are engaged.

Through the courtesy of D. F. Reynolds, foreman, and G. N. Deitrick, superintendent, of the foundry department of the Sandwich Enterprise Co., Sandwich, Ill., we are enabled to present to our readers illustrations of a torsional testing machine employed by this firm. Fig. 1 is the plan of the machine, in which A denotes the bed plate, on which are mounted three brackets, B, C, D, to support the testing mechanism. The bracket marked D has a square slot corresponding

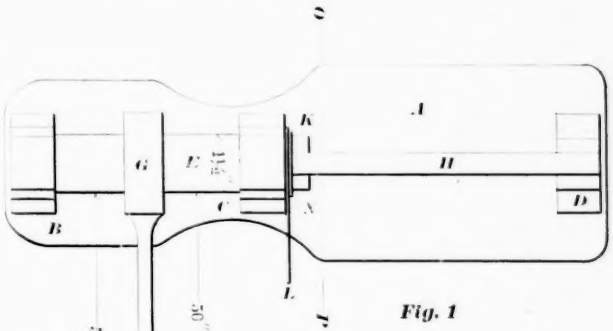

Fig. 1

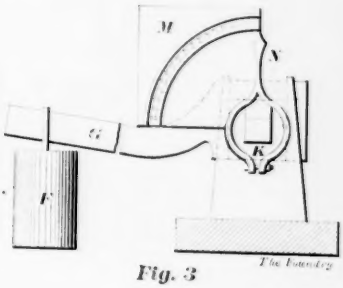

Fig. 3

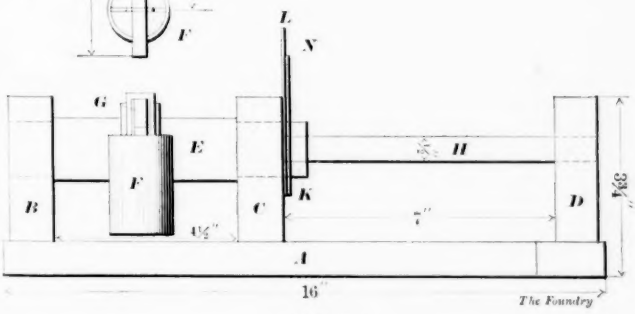

Fig. 2

to the size of the test bars, in this case ½ inch, which prevents the bar from turning when the test is applied. The brackets B and C are provided with a circular aperture enabling the sleeve E to revolve when weight is applied to the bucket F. The

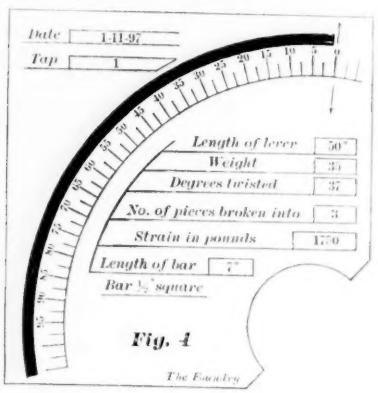

Fig. 4

sleeve E is a piece of cast iron made square to permit of it being gripped by the lever G. One end of this sleeve K has a square slot corresponding with a similar slot in the bracket D, by which the test bar H is held firmly in position.

A shield L is fastened to the bracket C, to which is attached a testing card M, Fig. 3, a fac-simile of which is shown in Fig. 4. To the sleeve E is fastened the pointer N, which revolves as the weight is applied, showing the torsional strain to which the test bar is subjected, in degrees. Fig. 2 is the elevation of Fig. 1, while Fig. 3 represents a sectional view on the line O P, showing at a glance the essential features of the construction.

The most important dimensions of the parts are given in the illustrations. The diagram Fig. 4 is filled out and filed away for further reference. Mr. Reynolds informs us that the average test varies between 35 and 47 degrees. The length of lever G from where the bucket F is suspended to the test bar is 50 inches. Beginning with 24 lbs., weight is added until the bar breaks, averaging in the present case between 32 and 33 lbs.

This example of testing, aside from its general utility, is interesting, as showing that several of our foundrymen are giving the subject a good deal of thought. The machine was originally constructed by Mr. Deitrick, and has given universal satisfaction in actual practice.

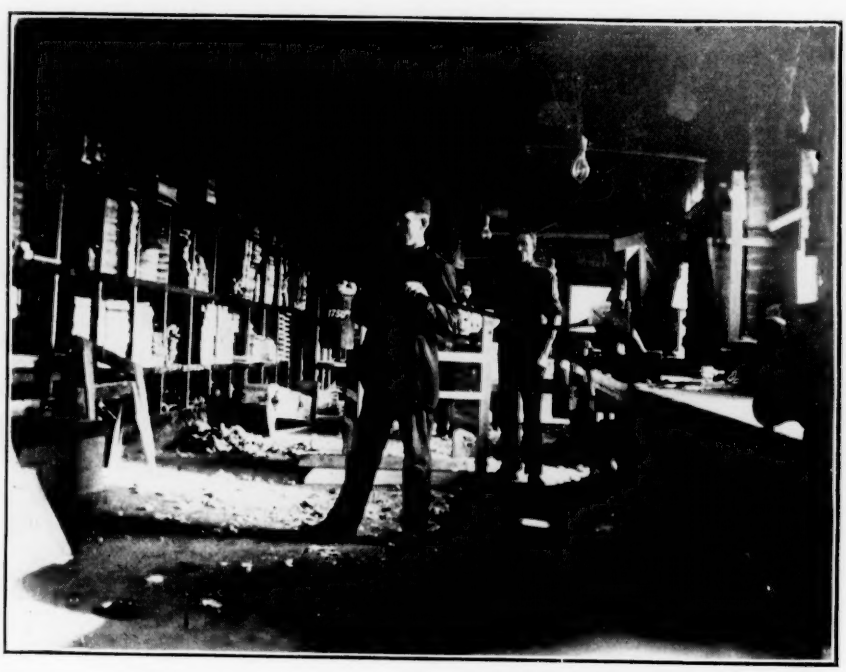

FIG. 5—A SIMPLE TESTING MACHINE.

A Modern (?) Foundry.

Strange are the lessons and experiences which sometimes cross our path in the way of improvements, modern machinery and the benefit derived from its use often destroying the fancied structure of security reared around a concern possessed of a foundry fitted with the latest improved facilities and machinery. An improvement is that which cheapens the cost or benefits the quality of an article to be produced. On this point all will agree, but there are other considerations which enter into the adoption or use of the same.

When an improvement costs so much that the saving effected by its use will not return over two or three per cent profit per annum, and the firm borrows money at eight per cent to carry on its business, its improving quality is a matter of conjecture; or when a concern follows the policy that for every thousand dollars' worth of added machinery or fixtures the office expenses and salaries should be increased in proportion to the value of the plant, there will be serious drawbacks to the success of the improvements to show large dividends at the end of the year. Improvements in shop practice or machinery should not call for more expense in office or salaried men; on the contrary, it should reduce the same. This is not said with the assumption that the same office force which handled a business of ten thousand dollars a month could take care of fifty thousand, but the amount of money invested in a plant or the expensive machinery owned should not be the criterion to regulate and adjust the salaries and expenses of the office, and the violation of these principles has often brought surprises which were not acceptable.

Quite recently, in a certain city, a fair-sized contract of architectural work was to be let. There were two foundries in the town, and both representative of the classes we meet so often. One a well equipped, well managed plant doing the best of work economically so far as shop practice was concerned, the other a place which was built before the war, and the fixtures and rigging of that date were nearly all it possessed, and they were crude and incomplete. Both desired the contract, for business was dull, neither shop running full time, and the figures presented were close to cost by both parties, and strange or not, as it may appear to the readers, the poorly equipped shop received the contract fairly by putting in a lower bid.

It was not thought possible such a thing could be, when the well equipped establishment cut prices low and possessed so many advantages, and the place was visited with a view to inspecting how they could take contracts at such figures and come out whole, and a slight description of the shop may be interesting if not instructive.

The buildings of the concern were a motley group of brick, wood and corrugated iron, built presumably at different periods with whatever material was cheapest; the windows were broken in many places and patched up with boards, the roof was as shaggy and ragged as a tramp's head after a night's repose in some strawstack, and its walls would have trembled with fear had a paint brush been brought to view.

The first place entered was the foundry, an old frame structure whose sides had rotted and been patched with sheet iron, old tin or any other convenient article; the roof was low, with no openings in the top to let out the smoke and steam, except what time had rent by the ravages of wind and rain; a half dozen small, dirty windows around its walls, and these gave all the light the place received. The molding room, core room, core oven, cupola, scaffold and rattler were all located within this room, and when business was dull it was also used for a flask yard. The cupola was situated about the center of the shop, probably through consideration for the molders, so they would not have to carry their iron far, and down in a hole or depression about thirty inches deep and ten feet in diameter, the bottom plate coming level with the surrounding floor, leaving a hill for the molder to carry his iron up when he carried a ladle, and making an excellent place for the accumulation of the rubbish a foundry is sure to collect. It was also unsafe, for the reason that during a very hard rain the water would run in the shop and down this basin, dampening the floor and causing a miniature dynamite explosion when the bottom was dropped. The cupola of itself was a work of art. It had been built from an old boiler shell which looked like it had went through the fate of boilers which experience too much fire and too little water; when lined up it probably

measured thirty inches clear of the brick, and was probably eight feet to the charging door. The bottom plate had been made in open sand, and was about three-quarters of an inch thick, embellished in several places with patches where it had broken. At one time it had been supported by four round legs, but some farmer had wanted a piece of round pipe for some purpose in the past, so one of the legs had been removed and a pile of bricks raised under one corner in its place. In front, about three feet above the bottom plate, was an enormous patch extending half way around the cupola, which inquiry about elicited the information, the lining had fallen in one evening and burned a hole through the shell. The tuyeres were two five-inch round holes in the sides, coupled to the blast pipe with old boot legs, while the blower, strange to relate, was in good condition and one of the best makes. The scaffold was a rickety structure about seven feet high, one end of it being nailed to the building, the other supported by a couple of 4x4 inch timbers which were six or eight inches too long, using for a foundation the corners of the cupola plate. No fancy automatic elevator or substantial runway with car and friction hoist graced it as a means for raising the material, but the pig iron, scrap, coke and wood were carried into the shop and up a flimsy pair of stairs by hand. In one corner of the shop was situated the core oven and core bench; the oven had an arrangement which might be called a car, but from the accumulation of ashes and dirt around its wheels it might just as well never run; probably they had forgotten it had wheels. Two cranes were fitted in two other corners of the shop, about eight or nine feet high, with the same amount of swing; they were fitted out with block and tackle; one had a rather dubious looking arrangement to rack in and out with, the other was stationary. Between the cranes set an old stove with a rusted out pipe, which constituted the heating arrangement of the place; no coils of steam pipes there, no hot blast driven through the shop by a blower to make the place habitable, but it was a shop that looked, as truly as it was in reality, a relic of by-gone days. The hand of time had left the impress of its fingers upon everything, which was decaying and falling to pieces. The flasks were old and rotten, some of them no doubt had been used as targets for the soldiers' rifle practice during the war, many were fastened together with wooden keys, while others showed holes where nails had rusted out. Of course there were some new flasks and a few which had been recently repaired, but the most of them would never stand the rapping maul used to-day in foundries for two heats. Even the molders were in keeping with the place, several old-time hands, slow and deliberate, those characters we sometimes meet, who smoke their pipes and spend a certain portion of their time talking of the good old times, when fourteen molders worked in a space ten feet square. Men who could hold a situation no place else were the occupants of this pile of ruins.

One thing, however, we noticed, they possessed in abundance, namely, gaggers; this was no doubt necessary on account of the elegant condition of their flasks. But time and space forbid a thorough description of the foundry, if aught be said of the remainder of the plant. Next the foundry the blacksmith shop was located, which contained several forges and a few blacksmith tools scattered promiscuously around the place, being tramped in the floor because there was nowhere to hang them. Two of the three windows had been broken down and nailed up with boards, leaving only one to furnish light, except what came through the roof, which was in a deplorable condition. A picket fence would have turned more rain than it, if placed above during a storm. The question as to how men worked in such a place when it rained met with the response, "they didn't work, they laid off." It was no doubt like the roof of the mansion, so often referred to in American legend, the home of the Arkansaw fiddler.

The machine shop was the next place visited, and was undoubtedly the best cared for part of the business. The building was brick, and the roof did not leak, for at this place it was two-story high, but the tools were old-fashioned and rusty, all of them covered with grease and dirt, and none of them showing that any care or cleanliness was thought of, except what was necessary to permit the machine to run. The tools, drills and other little necessities could be found in any part of the shop. Up a dark pair of stairs we were then conducted to the pattern shop and pattern storehouse, where a sight met our eyes which beggared descrip-

tion. Patterns were stored here that cost thousands of dollars, but in the utmost confusion and chaos. The small patterns, lugs, hinges, core points, hubs and similar stuff, were piled together in several unseemly masses, and when any particular piece was desired the pattern-maker would start and pull over one of these piles until what he was looking for was resurrected, and then leave everything just as he had thrown it. Numbers of larger patterns showed marks of the saw, where the pattern-makers had cut pieces from them when short of lumber. Along the walls and overhead in poorly constructed racks or shelves were mixed together patterns for engines, boiler fronts, columns, sills and machinery of every description, while in several places a pile of expensive patterns lay directly under some bad leak in the roof, which the drip from had decayed and rotted till they were falling to pieces. Indeed, the place appeared more like a tomb or forgotten storehouse than part of a business which entered into competition with live business enterprises.

From here our steps were turned to the storeroom, which was situated between the warehouse and machine shop. It had one window, a small one at that, which admitted little light on account of the curtain of dust and cobwebs which enveloped it. All around the sides were boxes and drawers in which bolts, nuts and screws were supposed to be kept, but instead whatever they chanced to have in stock could be found laying on the damp floor in front of the boxes, being gradually consumed with rust. Behind it was the warehouse, a large, low room, but packed and jammed with everything imaginable, one of the greatest curiosity shops a mechanic ever saw. In one corner set an old traction engine of antique manufacture, by its side part of an old threshing machine, next was an old dismantled gas engine, and three or four burrs from an old flour mill standing by its bed-plate. In another corner was a sewing machine, an old forge blower and a turbine water wheel. The whole place was literally filled with a motley collection of old and ancient mechanical remembrances, cane mills, cider mills, lard presses, circular saws, pulleys, gears and fly wheels of every conceivable design and pattern, chains rusted half way through the links, coils of rope in which several generations of rats had lived and made their nests in security; grate bars, sash weights and repairs of every description. It almost appeared it was a collection for a museum of some future period.

Out in the yard the same disorder prevailed. Castings in some cases had lain so long that they were half buried in the ground, several old boilers lay deeply imbedded in the refuse from the foundry, rusted almost through. The same condition prevailed everywhere, nothing was repaired except when it fell to pieces, improvements were unknown. A good live mechanic would have turned up his nose and walked out of the shop had he been offered such facilities to work with. Yet this concern, this back number in American foundry practice, was competing with modern equipped shops successfully. But, last of all, we visited the office, a neat, cosy little room, with only one desk and a draughting table, and were pleasantly received by the proprietor, who, when asked how he could produce work with such facilities and compete with large and well fitted establishments, said: "There is nothing strange about it at all. This is my office, I am proprietor, bookkeeper, shipping clerk, draughtsman and foreman. I hire no man but what is a producer, except, perchance, a laborer or two. I simply have to pay for labor and material. Office help I do not need, no drain is made on my income for clerks or bookkeepers to figure out how much I lose, no draughtsman wiles away his weary hours putting upon paper fancy theories of possible machinery which never materializes.

Don't I have too much to attend to sometimes? No. I only try to do what business I can look after myself. Paid assistance is not only expensive, but often unsatisfactory, and when business is dull I have no high-priced sponges to absorb what little has been made. Whatever there is in a job above material and labor is mine; office expenses of three or four dollars a ton never confront me when making a bid for castings. The place is run down and old. Do I ever figure depreciation and the loss of the plant? Yes, I did that years ago, using as a basis ten per cent per annum for the same, but was compelled to quit as the years rolled around and the books began to show my place worth less than what I pay a laborer for a week's wages.

I buy no machinery, nor spend time polishing tools or cleaning up places that won't

stay clean, and although the appearance may not be pleasant I realize a good, comfortable living from my business.

We left his office and walked down the street, mystified but possibly wiser men. The idea that red tape, extensive advertising and expensive machinery meant cheapened production had experienced a decided shock, and the ideas taught by this picture lesson will possibly be recorded in the next number of THE FOUNDRY.

Open and Closed "Feeding Heads" and "Risers" in Pouring Castings.

By R. D. MOORE.

In reply to Mr. West in the February issue, I would say that I never opposed the practice of covering risers, always letting the molders do what they pleased in that matter, but merely claimed that I had never seen the proof of its value in saving castings.

I presume the real evil of molders depending upon covering risers to stop blowing or scabbing, and also the almost universal foolishness of lighting vents for the same purpose, lies in taking his attention and care away from the real cause, a badly made mold. In a properly made mold the steam and gas generated by the hot metal escapes through the sand downward or away from the metal; if this means of escape does not form the easiest outlet they will then escape through the metal, producing what is called a "blow." The gases generated above the metal in the unfilled mold appear to escape harmlessly through the open gates.

My observations have extended through many years of experience in moderately heavy green sand work before skin-drying was adopted. I will name sugar mill and rolling mill housings, western steamboat shafts with a 30-inch locking flange (up to 1852, when wrought iron was adopted), marble facing plates, ten feet in diameter, etc.

These castings weighed between two and five tons each, a large part of them cast with open heads and not one lost.

Other opinions of students might be interesting reading, and is solicited.

Making Castings Grow.

Now that spring time is coming and the farmers are beginning to prepare the ground for future crops, it may be interesting to our readers to know that a metallurgical friend of ours, Mr. Outerbridge, of Philadelphia, has been cultivating a very peculiar plant for nearly a year past, which has been steadily growing in the arid soil of a foundry and has not yet reached full maturity. The plant we refer to is a cast iron test bar.

Two bars were cast side by side in one mold from patterns 1 inch square and 15 inches long, between the ends of iron yokes. The bars when cold measured almost the same length, differing only .001 of an inch when placed within the yoke and carefully measured with a graduated steel wedge. The shrinkage of one bar was .184 of an inch, the other .185 of an inch.

The shorter bar was then heated by pouring about ten pounds of molten cast iron over it, the bar forming the bottom of an open mold.

On the following day this bar was again measured, and now showed a shrinkage of only .150 inches. The experiment was repeated, and on the second test the steel wedge showed a space of .128 inches between the bar and the yoke. Six times this test was repeated, each time the bar growing longer, and, on the seventh heating, it would no longer fit between the ends of the yoke, showing that the bar had now grown to the full length of the mold in which the molten iron was originally cast. In other words, the natural shrinkage of the metal had been entirely eliminated by the gradual increase in length due to the successive heatings.

The bar increased also visibly in thickness, and after the third melt it became crooked, and its position was then reversed each time that it was placed in the mold for heating, in order to obviate this corkscrew tendency.

After twelve successive heatings and coolings the bar measured a full quarter of an inch longer than its companion, and also lost its tendency to become crooked on heating.

After fifteen repetitions the bar increased in length much less than before at each heating, and though it had not finished growing, curiosity to ascertain the effect upon the strength of the metal prompted the experimenter to break both bars upon the testing machine. The untreated bar broke at a strain of 2,150 pounds (transverse or cross-section stress) and showed a deflection of .15 inches. The metal was open grained,

soft foundry iron, such as is used for casting small pulleys.

The companion bar, which had been subjected to fifteen alternate heatings and coolings, as described, broke at 1,250 pounds and showed a deflection of only .1 inches, while the grain of the metal was changed to a dull lustreless, close fracture, very dark in color. This fracture resembled the appearance of "burnt" grate bars.

It has been heretofore always supposed that grate bars are changed in their molecular and chemical structure by the combined action of sulphur in the fuel and of the heated oxygen of the air in the furnace, the latter burning out the carbon.

Tests made by the same experimenter a few years ago showed that while there is some truth in the first proposition, the second is more or less fallacious. Some burnt grate bars showed no loss of free carbon when analyzed for that element. Such bars are, however, always exceedingly weak or brittle, and this is doubtless the reason that they are supposed to have been robbed of free carbon by the flames of the furnace.

This curious experiment with the "growing casting," which we have described, is not only interesting as a novel investigation, but it casts new light upon the cause of molecular changes in cast iron when subjected to alternate heating and cooling, and also furnishes valuable information as to the very serious effect upon the strength.

Vent and Venting.

By L. C. JEWETT.

In a former article I attempted to show the advantages absolute bare dry sand possessed as a steam absorber and gas preventer, when used under 4" or so of nicely tempered facing and heap sand in the floor or nowel or drag, and recommended its use in molding pans (not fans as your printer made it read) plain plates, or anything where there is much surface.

I am now making certain castings where absolute soundness is required on the greater portion of the cope side, as cast, dry sand is used in the nowel outside of 3 or 4" on joint and hub of pattern, the result being that the castings are exceptionally clean and sound.

Before using this, as I will term it, dry sand backing treatment, the hub, or rims, were seldom perfect and 25 per cent were no good.

I had an uncomfortable experience at one time with some balance wheels for printing presses, where the hub and rim and arms were demanded by the customer to be perfect and free from all blemish. The hubs were constructed with a web-like plate some 3½" wide by 1" or so thick, to which the oval arms joined, arms being quite wide at the junction to plate made the point of sand between arms quite narrow. The thorn that irritated the sides of molder and foreman was that when the top of hub was squared off in machine shop a spot would be disclosed of stogy sponginess.

This would sometimes be observed on the web around the hub, or in an arm, and sometimes in more than one place. The casting otherwise was all right, no scabbing was to be seen. The foreman observed the molder in the act of swabbing his pattern previous to drawing it, and noticed that around the hub and between the arms where the point of sand was narrow quite a quantity of water lodged and was drained from the swab as it was carelessly run around between the arms so much so as to cause the water to stand on that surface in a puddle. Instructions were then given to the molder to mark that mold so he could identify the wheel if it proved defective when bored out and squared up.

Further instructions were given to put as small a quantity of water as possible on joint when swabbing future patterns, especially where joint was narrow between arms, and after riddling good tempered sand for a facing to back that up with the drier sand in the rear of his heap.

The result of this change was a complete cure of the trouble and the wheel the molder marked that had the joint deluged with water, had the stogy spongy places in the hub that had been called "dirt in the iron" by every molder that had lost their wheels in that manner.

I am more than pleased with THE FOUNDRY.

FRANK MEGOW,
Propr. Star Foundry,
Independence, Ia.

Western Foundrymen's Association.

The regular monthly meeting of the Western Foundrymen's Association was held Wednesday evening, March 17, 1897, at the Great Northern Hotel, Chicago, the President, Mr. A. W. McArthur, in the chair.

The following report was received from the Committee on Apprentices:

In considering the suggested amendment relative to the propriety of providing some special inducement for young men having graduated from a Manual Training School to take up the trade of iron molding and founding, we believe the desired end can be best accomplished by making a separate indenture for this class, believing such graduates will make the most desirable mechanics, and that their preparatory training will have given them such knowledge of the business that it will not take them as long to learn as the boy with only a common school education. We would, therefore, advise a shorter term for these young men in each class, with a modification of the duties. We would also advise a more liberal compensation as an extra inducement. We do this on account of the fact that young men having passed through manual training schools are better developed, and, of course, have greater earning capacities, than those entering the trade who are for years their juniors. This fact, coupled with their better training and higher education, make them entitled to higher compensation.

We submit for your consideration the following indenture to provide for this class of applicants:

INDENTURE FOR MANUAL TRAINING SCHOOL GRADUATES.

This agreement entered into this....day of ....., 189—, between....., a firm or corporation organized under the laws of the State of....., party of the first part, and ....., a Manual Training School graduate, party of the second part.

Witnesseth: That the said party of the first part agrees to take said....., party of the second part, into its employ and service for the period of three (3) years from the date hereof for the purpose of learning the trade of iron molder, as carried on in its works, and that the said party of the second part shall truly and faithfully work and serve for said period in such capacities as the foreman may from time to time direct, and that he shall obey all rules and regulations of the works, and the party of the second part also agrees to abstain from the use of intoxicating liquors during the term of apprenticeship. The duties of the apprentice are defined as follows, but may be deviated from so long as it does not impair the apprentice's opportunity to learn the trade thoroughly: First three months to be spent at taking care and charging of cupola, also lining ladles; next six months in core room; the last three months of first year to be spent at bench molding.

The second year is to be devoted entirely to molding, the apprentice to be advanced from the small and plainer work to the more difficult and larger as fast as his capabilities will prove it is profitable to do so.

The third year is to be devoted to the most responsible work in the shop, either in dry or green sand, as the capabilities of the apprentice may justify, and should he desire to learn loam molding, it will be necessary for him to devote one further year to this special branch of the trade.

Compensation shall be as follows: First year, $6 per week; second year, $7 per week; third year, $8 per week, and where fourth year is taken up, $10 per week.

We do not consider that a bonus for extra efficiency will do any good in this class, as the incentive that impels young men in this class to take up this line of work will be all the encouragement necessary, and for the same reason we do not consider it necessary to retain any portion of the wages.

Your committee also, acting on the suggestion contained in Mr. Gates' letter, would earnestly advise the appointment of a standing committee by your association, whose duty shall consist in visiting such manual training schools as are within its jurisdiction, for the purpose of conferring with the faculty relative to the best methods of training boys to become interested in foundry work, and also to see that their equipment is adequate to assist in accomplishing the desired end, and for a mutual exchange of ideas and suggestions; said committee to report at each meeting of the association.

Referring to regular indentures in class No. 1, in defining the duties in the fourth year, your committee would now ask to have that changed so as to read, "the full year to be spent on the best class of work in the

shop, etc." Also, in the first year, so as to read, "nine months of first year to be spent in core room, etc., and three months at cupola and lining ladles."

Terms in class No. 2 for manual training school graduates, we would advise as follows: First three months to be spent in taking care of patterns and to be generally handy; next three months at care and management of cupola and lining ladles; two years following at molding in all its details from the simplest to the most difficult work, and the apprentice to be advanced as rapidly as he proves himself competent. Compensation for the first six months to be $1 per day, and $1 per week increase for each year, for balance of apprenticeship, where day work is the rule, and where piece work prevails the same terms as in regular indenture.

While not wishing to discourage manual training school graduates who wish to take up work in class No. 3, we cannot imagine a case where a young man with such schooling would select this branch, but to provide for such we believe the present indenture entirely suitable and can suggest no changes. We would, however, strongly recommend that the requirements as to fitness of apprentice recommended in regular indenture shall also apply to these special apprentices.

WILLIAM FERGUSON,
G. H. CARVER,
A. M. THOMPSON.

Upon motion, duly seconded, the report was accepted and the committee discharged.

Upon motion, duly seconded, a committee of three, consisting of James Frake, H. W. Carter and William Ferguson, was appointed by the chair to revise the various reports of the Committee on Apprentices and to present to the association a final report, giving accurately the legal form of indenture which it would be advisable to adopt in each class.

The following paper on "Phosphor Bronze, Its Manufacture, Properties and Foundry Treatment," by Max H. Wickhorst, was read:

Bronze is an alloy of copper and tin. Phosphor bronze is bronze containing varying amounts of phosphorus from a few hundredths of one per cent to 1 or 2 per cent. Copper is a soft, ductile metal. Tin is also a soft metal. But by adding a little tin to copper, we harden it. By increasing the amount of tin we make the alloy still harder. When about one part of tin has been added to two parts of copper, we have an alloy that is very hard and brittle. When more tin is added the metal begins to soften again.

Bronze containing simply copper and tin is very liable to be defective from the presence of oxygen, sulphur or occluded gases. Oxygen causes the metal to be spongy and weak. Sulphur causes porosity. Occluded gases cause porosity. Oxygen gets into the metal by absorption from the air. It can be eliminated by adding to the metal something which combines with the oxygen and then fluxes off. Such deoxidizers are zinc, antimony, aluminum, manganese, silicon and phosphorus. Sulphur and occluded gases can be eliminated by melting the metal, exposing it to the air and letting it thus absorb some oxygen which then burns the sulphur and gas. The oxygen can then be removed by adding one of the above mentioned deoxidizers. The important use of phosphorus in bronze is therefore to remove oxygen and also indirectly to destroy occluded gas and sulphur.

At the C. B. & Q. R. R. brass foundry at Aurora, Ill., we make a bronze with an extra high percentage of phosphorus, namely 6 per cent. We make this alloy so as to have phosphorus in convenient form for use, and the process of manufacture followed by us is as follows:

Ninety pounds of copper are melted under charcoal in a No. 70 crucible, which holds about 200 pounds of metal when full; 11 pounds of tin are added, and the metal is allowed to become hot. The crucible is then removed from the furnace, set upon the floor, and 7 pounds of phoshorus are introduced. The method of adding the phosphorus is as follows: A 3-gallon stone jar, half full of dilute solution of blue vitrol is weighed. Then the weights are increased 7 pounds, and phosphorus in sticks about 4 inches long is added till the scales balance again. The phosphorus is left in this solution half an hour or longer. By this means the phosphorus is given a coating of copper, so that it may be dried and exposed to the air without igniting. We have ready a pan (Fig. 1) about 30 inches square and 6 inches deep, containing about 2 inches of water. Over the water is a wire netting which is laid loose on ledges or supports along the inner sides of the pan. On the netting is blotting paper, and on this the phosphorus is laid when

taken out of the blue vitrol solution. The phosphorus is put on the blotting paper to dry. The pan also has a lid which can be put down in case of ignition of the phosphorus.

We now have the phosphorus ready for introduction into the metal. This is done by means of a cup-shaped instrument called a retort, or phosphorizer. Its shape is shown in Fig. 2.

Having the molten metal ready on the ground, one man holds the retort on the rim of the crucible in a horizontal position, as shown in Fig. 2. A second man takes about three pieces of phosphorus and throws them

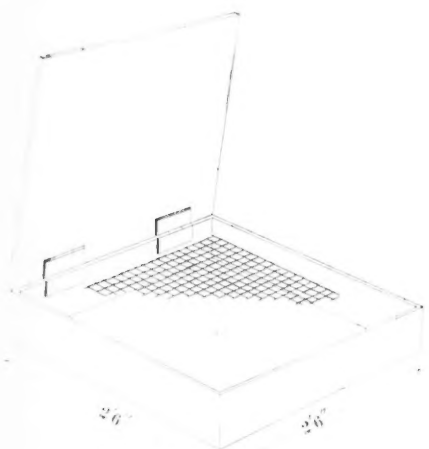

Fig. 1

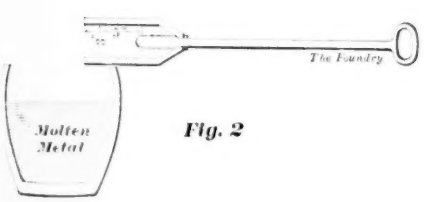

Fig. 2

into the retort. The first man then immediately plunges the mouth of the retort below the surface of the metal before the phosphorus has a chance to fall or flow out. Of course, the phosphorus immediately melts and also begins to volatilize. As the phosphorus comes in contact with the metal it combines with it. This process is continued till all the 7 pounds of phosphorus has been put into the metal. The metal is then poured into slabs about 3x4x1 inches thick. The metal is so hard that a greater thickness would make it difficult to break it up. When finished, the metal contains, by analysis, 6 per cent of phosphorus. When we wish ordinarily to add phosphorus to metal we do it by adding a little of this hardener.

I will now discuss the properties of copper and the various bronzes. Copper is a soft, ductile metal with its melting point at about 2,000 degrees F., or 1,100 degrees C. Molten copper has the marked property of absorbing various gases. It is for this reason that it is so difficult to make sound castings of clear copper. Molten copper combines readily with the oxygen of the air, forming oxide of copper, which dissolves in the copper and mixes homogeneously with it. This explains why melted copper has a clean surface, free from all scum; that is, as the air acts upon the copper, the oxide formed dissolves in the rest of the metal, leaving the surface clean. A casting made from such metal would be very spongy. The bad effect of oxygen is intended to be overcome by adding zinc to the extent of 1 per cent or more. This result can be much more effectively attained by the use of aluminum, manganese or phosphorus. The action of these substances is to combine with the oxygen, and as the product formed separates and goes to the surface, the metal is left in a sound condition. Aluminum and manganese deoxidize copper and bronze very effectively, and the oxide formed goes to the surface as a scum. When a casting is made from such metal, the oxide or scum, instead of freeing itself from the casting perfectly, generally remains in the top part of the casting mixed with the metal, as a fractured surface will show. Phosphorus deoxidizes copper and the oxide formed leaves the metal in the form of a gas or white smoke, and a casting made from such metal shows a clean fracture throughout, although the metal is not as dense as when aluminum or manganese is used.

Copper also has the property of absorbing or occluding coal gas or carbon monoxide. But the coal gas thus absorbed is in a different condition from the oxygen absorbed. When oxygen is absorbed by copper the oxygen combines chemically with the copper and loses its own identity as a gas and actually forms part of the solid. But when coal gas is absorbed by the copper, it keeps its own physical identity and simply exists in the copper in a state of solution. Just, for instance, as air and other gases dissolve in water. All natural waters, such as lake water, river water, spring water, etc., con-

tain air in solution or occlusion. When such water is cooled and frozen, just at the time of changing from the liquid to the solid state, the dissolved gas separates and forms air bubbles, which remain entangled in the ice. And the coal gas which is dissolved or occluded in copper acts in exactly the same way. Suppose we cast some copper or bronze containing coal gas dissolved in it. While the metal is in the molten condition it is perfectly quiet, since the gas has no tendency to come out. We pour the metal into a mold of sand. The metal flows in all right. About two minutes or so after the metal has been all poured we notice that the gate begins to rise. This is because, just as the metal is setting the gas separates itself and assumes the gaseous form. Therefore, as this gas takes up more room it forces the metal out through the gate. After such a casting has been allowed to cool and all the sand has been cleaned off, the surface of the casting will be free from all signs of holes in the metal. But if we take a cold chisel and chip into the top side of the casting, or have the top skin machined off, the casting will be found to be full of gas holes and, in fact, in a bad case the metal will be almost a sponge in appearance. The point I wish to emphasize is that one cannot tell whether a casting is porous by looking at the outside, since the gas which causes the porosity is evolved only after the skin has set, and therefore as the evolving gas rises to the surface of the casting it can get to the skin, but no farther.

Hydrogen acts in exactly the same manner as coal gas.

Sulphur also has a bad effect on copper and bronze in a similar manner to coal gas and hydrogen. Sulphur combines with copper and other metal, forming sulphide of copper, etc. When molten copper or bronze containing sulphur comes in contact with air it absorbs some oxygen and this in turn combines with the sulphur present, forming sulphur dioxide, which is a gas which remains occluded in the metal exactly the same as coal gas does and is liberated when the metal sets, also in the same way. If the metal is allowed to absorb more oxygen, the sulphur is oxidized to a higher oxide, which does not remain in the metal but goes off in fumes.

Tin is a soft white metal, melting at 440 degrees F. or 230 degrees C. Toward gases it acts something like copper, but not in so marked a degree. Although copper and tin are both soft, yet when mixed they make a harder metal. This is because copper and tin combine with each other chemically, to form a hard and very brittle substance. About two parts by weight of copper combine with one part of tin so that both substances are neutralized and there exists no free copper and no free tin, but the mixture consists entirely of the copper tin compound. Both the copper and tin have lost their own identity and no longer exist as such, but are chemically combined to form a compound which is very hard, brittle and gray in color. If more copper or tin is used than this, the two metals still form a chemical compound mixed with the excess of copper or tin, as the case may be. In bronze we have a copper tin compound, mixed with excess of copper, but we have no free tin. When bronze cools from the molten state, the copper and the copper tin compound tend to crystallize by themselves. The quicker the cooling occurs, the less separation will there be, and also the fracture will be more homogeneous in appearance.

When bronze contains occluded gas, it is probably the free copper entirely which occludes the gas. I judge this from the fact that in the fractured surface of some bronze defective from such gas, the gas cavities are mostly bright yellow in color, while the gray spots are compact.

Gun bronze contains copper and tin in the proportion of 9 or 10 parts of copper to 1 of tin. This is the metal used where an ordinary bronze casting is wanted. A harder bronze is copper and tin in the ratio of 6 to 1. This is often used as a bearing metal. When either of these metals is to be turned in the machine shop, they should contain about 3 per cent of lead, which will make them work very much better, but it also decreases their tensile strength. Bearing metal now generally contains about 10 per cent of lead, with copper and tin in varying ratios. The large percentage of lead is put in that the metal may wear away slower. Lead, although a metal having properties similar to tin, acts entirely different towards copper. Copper and tin have a good deal of affinity for each other, but copper and lead show no attraction at all for each other. Copper and tin mix in all proportions, but copper and lead mix only to a very limited extent. About 3 per cent of lead can be mixed with copper. With bronze

15 to 20 per cent of lead can be mixed. In bearing bronze, the lead keeps its own physical properties, so that the constituent lead melts long before the metal attains a red heat. It sometimes happens when a bearing runs warm, that the lead actually sweats out and forms pimples on the metal. Or sometimes in remelting a bearing bronze casting the lead may be seen to drop out while the metal is warming up.

All of the metals, however, should contain something to flux or deoxide them, such as zinc, manganese, aluminum, silicon, antimony or phosphorus.

I will describe the method of preparing phosphor bronze bearing metal in vogue at Aurora. The metal made has the following composition:

Copper	79.7 per cent.
Tin	10. "
Lead	10. "
Phosphorus	0.3 "
	100.0

Melt 140 pounds of copper in a No. 70 pot, covering with charcoal. When copper is all melted add 17½ pounds of tin and 17½ pounds of lead and allow metal to become sufficiently warm, but not any hotter than is needed. Then add 10 pounds of "hardener" (made as previously described) and stir well. Remove from furnace, skim off the charcoal, cool the metal with gates to as low a temperature as is consistent with getting a good casting, stir well again and pour. We face our molds for this kind of work with plumbago.

When good copper is used this procedure will always give a good sound bearing metal. However, as some kinds of copper on the market are very liable to contain sulphur or occluded gas, this kind of copper should be melted without covering, then exposed to the air to allow it to absorb oxygen, and thus oxidize out the sulphur and gas, stirring it well several times. Then add lead and tin, remove from the furnace, add "hardener" and stir well. The idea is to allow the metal to absorb some oxygen, which removes the sulphur and occluded gas, and then to remove the excess of oxygen by adding phosphorus. As we buy copper on chemical specifications which insure good copper, I have had very little experience with poor copper.

There are several firms that make phosphor bronze bearings with a composition similar to the above one, and most of them, or perhaps all, make it by melting the metals and then charging with phosphorus to the extent of 0.7 to 1.0 per cent. But I have found some metal from all brands that I have tried that contains occluded gas. So that after such metal is cast, in about two minutes or so the metal will be found to be porous. But I have not yet had one such experience with metal made as I have described above. My explanation of metal made by adding phosphorus direct to the final mixture containing occluded gas would be this: The phosphorus, as it is charged into the metal still contains a little moisture, and at the high temperature of the molten metal, the phosphorus takes the oxygen from this water, leaving the hydrogen to be absorbed by the metal. Whether this theory is correct or not, I cannot say from any experiments I have made. I merely offer it as a suggestion.

But this practical point should be heeded, viz.: That pig phosphor bronze should be bought to the specifications, that the metal should have shrunk in the ingot mold in cooling, as shown by the concave surface of the upper side, and that it should make a casting in a sand mold without rising in the gate after being poured.

In bearing metal, occluded gas is very objectionable because the gas in trying to free itself shoves the very hard copper-tin compound (which has a low melting point and remains liquid after the copper has begun to set) into spots, and thus causes hard spots in the metal.

Phosphorus is very dangerous stuff to handle and there is great risk from fire with it, so that many would not care to handle the phosphorus itself. But phosphor copper containing 5 per cent of phosphorus, and phosphor tin containing 2 to 7 per cent of phosphorus and several other such alloys can be obtained in the market. And I would suggest to those who wish to make phosphor bronze, but do not want to handle phosphorus itself, to make it by using the proper amount of one of these high phosphorus alloys. In using phosphorus it is only necessary to use enough to thoroughly deoxidize the metal, say 0.3 per cent. More than this will make the metal harder but not any sounder.

During the reading of the above paper, Mr. Wickhorst submitted the following specifications for ingot copper used by the Chicago, Burlington & Quincy Railroad Co.

1st. Copper will be bought in ingots. Each ingot must have the brand of the maker cast upon it.

2d. Each ingot must show shrinkage in the mold in cooling, as shown by the concave surface of the open side.

3d. An analysis of the borings of an ingot, taken at random from a shipment, will be taken to represent the shipment, and must show the following chemical composition:

Copper not less than 99.65 per cent, and must be free from sulphur.

4th. A shipment failing any of these requirements will be rejected.

DISCUSSION.

Mr. Sweeney: How much phosphorus is lost in remelting?

Mr. Wickhorst: There is very little phosphorus lost if the metal is well covered with charcoal.

Mr. Sorge: What is the effect of phosphorus on bronze in regard to shrinkage?

Mr. Wickhorst: Phosphor bronze shrinks very little. The reason for that is this: Phosphorus combines with the air and forms a gas. When the metal is poured into the mold, of course there is more or less drawn off and forms the gas, and you have a metal that is not very dense and does not shrink very much. If you substitute aluminum it would combine with the oxygen and would form a scum and the metal would shrink very much more.

Mr. Carter: I would like to ask how high a percentage of copper you have been able to use in any metal and still have a hard casting?

Mr. Wickhorst: I have several times made castings of copper that contained only a very little phosphorus and they were perfectly sound.

Mr. Carter: What percentage would that show?

Mr. Wickhorst: Say you had your copper 100 per cent—to begin with you would have 99.5 per cent copper.

Mr. Carter: Is there any difficulty in making that kind of casting?

Mr. Wickhorst: I have not made many, but with those I have made I have had no difficulty.

Mr. Carter: Do you make your copper with the hardener, such as you speak of?

Mr. Wickhorst: Yes, with the phosphor copper.

Mr. Carter: There has been a demand for pure copper castings in electrical work and there is one firm that is making quite a claim on what they call a pure copper casting. I have seen the casting in sections and the fracture does not seem to show any porosity at all.

Mr. Wickhorst: They do try to get that with silicon copper. I have never tried that at all.

Mr. Sweeney: How does the slight percentage of phosphorus affect copper as to its electrical properties?

Mr. Wickhorst: I do not know.

Mr. Ferguson: Does the porosity you speak of occur more readily in the heavier than the light castings? Some twenty-five years ago I had something to do with brass. I remember I had a large valve to make—250 pounds, and in portions it would run to two inches in thickness. We used our ordinary mixture of brass that we used for bearings and boxes. The casting came out sound, but when we cut off the face it was nothing but a mass of porosity. I reasoned at that time that it was because of its being cast in green sand, so we remelted it and cast it over again in dry sand, but with the same result. I added more tin to the mixture and the casting came out as sound as a bell.

Mr. Wickhorst: Larger castings would show the porosity more because it takes them longer to cool and any gas that does come off has a better chance to show itself. The higher the percentage of tin is, the less tendency there would be to create gas. You can take this bronze with its occluded gas and by letting it absorb air it presses the gas out; then add phosphorus and you can get a good sound casting.

Mr. Sweeney: I would like to call attention to the fact that this paper emphasizes the value of chemistry in the foundry. The matter has been so largely discussed here that I do not think that we should let an opportunity slip to show the proof of the arguments we have made.

Mr. Geo. L. Roby, of Albion, Mich., read a paper on "Steel Cores," which is as follows:

The formation of smooth and approximately accurate holes in iron or brass castings always involves trouble and expense. The method proposed is to substitute when possible a little extra attention and labor in the foundry for the wear of machine tools, supplies, power and labor of the machine shop. Broadly speaking, the improvement suggested is to insert steel cores of the shape and size of the shaft or bar which the hole is to fit in the mold and afterwards remove them from the casting. This has been done in many foundries for years. But, except for special work, the objections of having to make tapering cores so that they may be removable and that the crystallization and chilling of the iron makes it difficult if not impossible to do any further work on a casting that cannot be brought to the emery wheel, have prevented the general use of steel cores.

Fig. 1

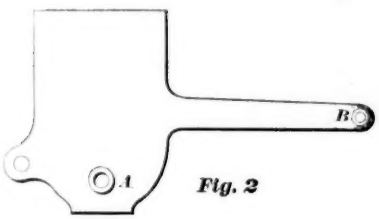

Fig. 2

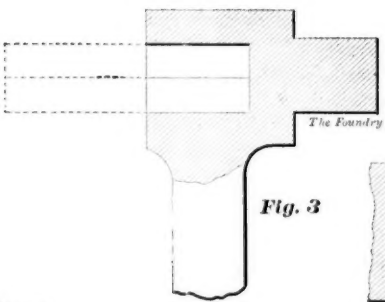

Fig. 3

Fig. 4

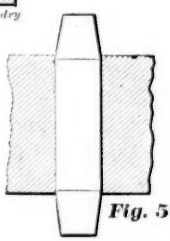

Fig. 5

It will be admitted, however, that if these steel cores can be coated with a composition which will resist the heat and pressure of the melted iron, be non-conductive enough to prevent "chilling," so free from gas producing substances as to reduce the liability of "blowing" to a minimum, of a nature not antagonistic to the iron, and to which it will lay hard enough when placed upon the steel cores to bear ordinary handling, and yet after the casting has been made, to become so soft as to offer no resistance to its removal, the use of steel cores is capable of a greater adaptation to modern foundry work than it has yet been given. It is not asserted that a steel core will work in all places. It cannot compete with a sand core for producing a hole that is good enough as made with the sand core without drilling or reaming. It has been found impracticable to cast a thin shell around a large steel core, but a thinner shell can be cast around a steel core standing on end than lying down in the mold. A thinner shell can be cast around a well proportioned pattern that can be poured slowly than about one having thin webs.

To be on the safe side, it is best to assume that if the core is standing on end it will not give any trouble if the outside diameter is at least equal to twice the diameter of the core. If lying down, the core ought not to exceed one-third of the total diameter of the adjacent part of the casting. Like all rules, these can be broken with impunity if proper precautions are taken, and we know we are beyond the danger line. If the pattern can be gated so a considerable amount of metal may pass through the part having the steel core set, or if enough of the pattern pro-

jects above, so that the pressure of the iron will hold it up, much more difficult results may easily be achieved.

In a case where it was desired to cast a finished hole in a very light wheel 7 inches in diameter that was gated to the rim, a large percentage of the hubs were defective at the upper end. The wheel when gated as shown in Fig. 1 gave no further trouble, although the hub was less than ⅞ of an inch diameter and had a ½-inch hole, 2 inches long. These wheels went from the trimming room directly to the erecting shop. The usual cost in the machine shop being entirely saved, and better fitting journals secured than when drilled in jigs. Another case of

Fig. 6

Fig. 7

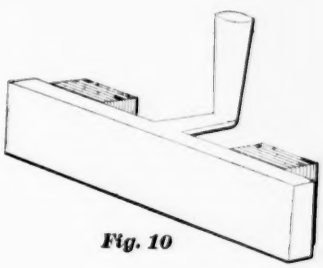

Fig. 10

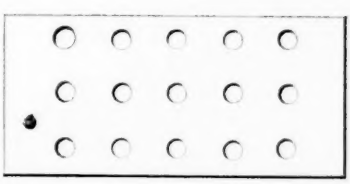

Fig. 8

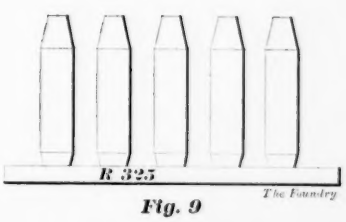

Fig. 9

finished work in this way was in making the castings for the frame of a small machine shown in Fig. 2. The two sides were joined so that if not set exactly right in the jigs the two sets of holes did not coincide. The shaft working in the bearings A and B were ½ inch and the bosses not ¾ inch at the end, the plates being about ¼ inch thick. Prints were put in and steel cores used. No trouble was had in casting them and a more satisfactory job was done than when drilled, but extra care had to be taken to see that the flask pins were a tight fit, and sometimes a long, straight reamer was run through to line up the holes, but the iron not being chilled gave no more trouble than when drilled.

In Fig. 3 is shown a place where a sand core had been used. Great difficulty was found in getting the holes a satisfactory fit for the purpose desired. The steel cores were cut from the stock used. A perfectly finished hole was obtained at a less expense than with sand cores.

One of the greatest chances for money saving is casting gears, or pulleys that are afterwards to be turned up, the chucking and boring being dispensed with. The castings, direct from the foundry, can be driven on their mandrels and turned up. With care used to keep the mixture at the proper consistency, the fit on the shaft will be as perfect as can be obtained. Irregular shaped holes, or cavities with smooth square bottom can be made with steel cores that can hardly be produced in any other way. Then again, on some light work too small to use sand cores at all, the steel core can be used to great advantage and very small holes can be made. Taking cast butts, for instance, the holes for the pin can be cast in more cheaply and perfectly than they can be drilled even with automatic machinery. Set screen holes can be cored in, and having no sand in the

holes the tap will last almost as long as drilled holes. Nuts for coarse threads can be made by placing a section of the screw in the mold, and every wide-awake superintendent who is not more firmly wedded to tradition than to the success and profit of his business will find many similar places for the saving of time and expense.

When lying horizontal in the flask the cores are, of course, only pieces of the stock that is expected to fit the hole cut off in the lathe or shaper with clean square ends; but when standing, the usual taper for cope to close over is essential. It is also suggested that the distance from A to B in Fig. 4 should be a trifle longer than the distance through the casting, so that there will be no danger of "capping over." If steel cores properly coated do not come out easily, it is when there is no chance for this reason. Note Fig. 5. On old patterns having small prints it is found convenient to make the core like Fig. 6 and do satisfactory work for small runs, but it will usually be found to pay better to add enough to the print as in Fig. 7.

In doing jobbing work where but a few pieces are made, it is often much quicker and cheaper to make steel cores than to make a core box and sand cores, even when the latter would answer.

Heavy or larger cores ought to have a hole drilled in the end for handling when dipping. The composition should be kept in tightly closed vessels when not in use, as the liquid is very volatile. A small pail with a tight cover will answer nicely. It should be deep enough to take the largest core, and only about 5 or 6 inches in diameter to let the hands in the top when dipping small pieces. Drying board should be provided for cores used in any quantity, and as they are dipped, set in the holes. See Figs. 8 and 9. This board should then be delivered to the molder, and it should be made a part of his duty to see that they are taken from the castings and returned to the core room. The board, if neatly made and with a familiar number of holes, makes a good check for preventing the loss of cores, and a convenient way to store in shelves when not in use. If the number or name of the casting is placed on the edge of the board it will add a still further convenience.

It must be remembered that a great deal depends upon the care with which the core is coated, and this should be entrusted to some employe who not only has an interest in the work, but a chance to see the results. If in proper condition the cores will drain off instantly, leaving a smooth black coat about 1-100 of an inch thick, without any runs or streaks. This will leave the hole approximately 1-100 of an inch larger than the steel core, varying somewhat on account of the size and shrinkage.

The composition is supplied by the S. Obermeyer Co., Cincinnati, O., and Chicago, in two grades already prepared, designated as A and B. The A grade is made for general work, light to medium; the B more especially for heavy castings, which, remaining liquid for some time after pouring, will burn off the A grade too much and make too tight a fit. If the A grade is used for heavy work on extra occasions, it should be used thicker than under normal conditions. There is no other way than by dipping that a satisfactory coating can be put on, and it is not advisable to try to dip the second time without cleaning off smoothly. The composition is a mixture of the most refractory and non-conducting substances known, which are held in suspension by a specially manufactured medium which is completely evaporated by the heat of the iron before they come into actual contact. Its non-conductive qualities are surprising. It would hardly seem reasonable to suppose that a coating of .01 of an inch thick would prevent the usual "chilling" of the iron. But how effective it is can be proven by placing two chills of equal size against a light bar, as shown in Fig. 10, one being coated with the composition and the other not. The gate should be placed between the two for absolute fairness.

Like all good things, it is best to use steel cores with moderation. They will not do everything; they must be treated with consideration, and coaxed, if need be. The experience every foundryman has had trying to cast around wrought iron will be applicable to their use with all differences in favor of the coated cores. In the hands of a foundryman willing to put up with a few unexpected results and to cultivate their good side they become very effective labor and cost reducers.

This paper was followed by an informal discussion.

It was moved and seconded that a vote of thanks be extended to Messrs. Wickhorst and Roby for their very valuable and interesting papers. The motion was carried unanimously.

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The Rhode Island News Company, Providence, R. I.
The San Francisco News Comp'y, San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Company, Toronto, Ontario, Can.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburg News Co., Brooklyn, E. D., N. Y.
The Wisconsin News Company, Milwaukee, Wis.

Trade Outlook.

If this world is just what we make it, then nothing else that we could say would better represent the situation among the foundries to-day. The shop that has refrained from doing anything in the hope that somebody would make things better finds itself without any encouragement, while those who have put their shoulders to the wheel and tried to make things better themselves have succeeded fairly well and are operating their works, at a small margin of profit, it is true, though this depends more or less upon the facilities and equipment which they possess.

The southern furnaces continue to dispose of their surplus pig iron to the export trade, but the volume of these transactions is small as compared to the home market. Some good orders have come forward, but they are not as numerous as expected, and in some instances there has been a disposition to shade prices.

The Scrap Heap.

The business situation continues to discount the mystifying powers of the fabulous Chinese or any other puzzle.

* * *

It continues to exhibit new and original features that eclipse anything or everything the wily Barnum or mysterious Herrmann ever dreamed of.

* * *

Nothing could be more complicated, mixed, unfathomable or uncertain than the future looked at from a business man's standpoint.

* * *

The one great encouraging feature is the restless energy of our people, their steadfast optimism and the fact that sooner or later we will and must recover from the collapse brought on by long years of prosperity, overproduction and inflated values.

* * *

We have not been helped, but rather hindered in this greatly-to-be-desired end by politics and politicians. On the one hand, there are those who believe and prove to their own satisfaction that the suffering of the past few years is owing to excessive tariffs. Then there is a set of statesmen who see the cause of all our present troubles in our present financial systems, and another

set who believe that the proposed reforms would be worse than present conditions.

* * *

Amid the whirlwind of uncertainty raised by all these contending factions, the business interests have naturally suffered immensely, but the chief agitators of extreme measures have either seen their error, been squelched for the time being or discovered that the country was tired of listening to them and wanted a rest, and this of itself is no unimportant factor.

* * *

It can not, however, be denied that all this discussion has caused something in the way of advantage. It has stimulated thought and been the means of educating our people on these problems in a way nothing else could have done, and this is a country governed, we might say, by universal suffrage of no small moment. We have found out that we must look to natural causes and staple government and freedom from great agitation involving our entire commercial relations and financial systems if we desire prosperity.

* * *

Waiting for some congress to meet and adjourn, for some certain issue of bonds to be floated, waiting for the harvest to be gathered, the springtime to come, waiting for elections to be over or some particular man to take office, waiting for the first of the year and its attendant inventory season to go by, waiting for a war scare to wear off or the fate of some particular piece of legislation to be known, all these flimsy pretexts have been worked, anticipated and found wanting, and now the average sensible business man has settled down to await the return of prosperity, with the hope that its arrival will not be hampered or restricted by scheming politicians.

* * *

Those who have waited or are waiting for the "times" to make them rich or prosperous or for politics to boom their business, have and will always have a hard time of it, while the alert, energetic man who makes the best of his opportunities and does always his best under all circumstances, will be the one to whom all phases of the business situation must bring its share of profit and glory.

No better demonstration of this could be suggested than the very peculiar condition of affairs existing in some of our European manufacturing countries—England, Germany, France and Belgium, who are now and have been for a couple of years past, enjoying a most remarkable degree of commercial prosperity, and in some instances are carrying on and rapidly adding to a very large foreign trade.

* * *

An unusually large percentage of the workshops are working over-time, others are running full-handed and a great number of American workingmen who have found the situation here discouraging have gone across the water and write letters to America that show a very different condition of affairs in Europe to what we usually believe exist.

* * *

The strange part of it is that some of these are high and others are low tariff countries, and this fact is dwelt upon at length by many advocates of a gold basis currency, as showing that tariff legislation is not everything.

Bucking a Mountain.

One of our exchanges, published in the interests of the stove trade, is agitating a movement against department stores for the part these are alleged to have taken in reducing the profits of middlemen, principally the retail dealer with a small establishment. By an improved system of handling goods these stores have been enabled to increase the purchasing power of a dollar to such an extent that the small dealer, having proportionately greater fixed charges to the amount of goods handled, finds himself losing trade. On the face of it, and judging by the general sympathy exhibited by the average man for the under dog in a fight, it would appear a laudable purpose to "buck" any innovation that threatens to disturb the usual vocation of a large number of people, and we should undoubtedly hold the same view, were it not for the fact that a study of economical laws has proven the utter inability of enacted ordinances or concerted movements to abrogate, much less banish, the power of anyone who, in a legitimate way, is able to undersell his competitors.

While the journal in question is trying to create a sympathy for the retail hardware dealer, it ignores another part of the question, and not a word does it say about the effect large stove manufacturers have on smaller concerns engaged in a similar line. With a large cash capital, a perfect system of working and the enforcement of economics due to a greater concentration of energy and the ability to direct this from a central point, small foundries which made stoves along with other castings but a few years ago have been compelled to give up this part of the business since specialization took place. The principle is the same in both cases. The large store buys as cheap as possible and sells with a lower charge for handling because of its perfect system of organization. The large stove manufacturer, too, buys his material in large quantities at a low cost, or at least lower than one could buy smaller quantities or on credit. Receiving a greater output per man and per dollar than his smaller neighbor, he secures an advantage which we fail to see how any law can remove. In fact, we never heard it mentioned that there would be any advantage accruing by prohibiting the large stove manufacturers from doing business in order that a lot of one-horse foundries might be opened. Yet the case is parallel in both instances. The large store hampers the small dealer. The large specialized foundry prohibits a small one from entering the same line. Boycotts have been placed upon goods on such occasions, ostensibly to give the little fellows a chance to live, but a boycott does not amount to much unless it is built on dollars and cents. The man who can produce or sell goods at the least cost has always come out a winner. Even those who advocate drastic measures to compel a compliance with what they are pleased to term just demands will renounce and abjure allegiance to the faith they are preaching by patronizing the very people they are denouncing. If it is illegitimate to reduce the cost of producing or selling, we have been a very long time in finding it out. Men have by this ruthless process been changed from one avocation to another, and if the retail hardware dealers are to be exempt from its vicissitudes and effects there are plenty of others entitled to the same privilege.

Demand and Prices.

Increased demand is by many relied upon as bringing with it an increase in the price of the article it affects. A notable exception to this is presented by the copper market. With the development of electrical energy a great boom was given to the use of copper throughout the world. Last year the output of the United States reached nearly 240,000 tons, of which fifty per cent was exported.

In spite of the increased demand, prices have fallen. This is owing to the better facilities provided for mining and other economics effecting a reduced cost in handling and transporting. It may be well to ask if the same reasons which have caused the price of copper to decline under a vastly increased demand, will not repeat themselves in the iron market. There is nothing surer than that we are, day by day, almost unconsciously lowering the cost of the product; in other words, we are making ourselves more useful. What a few years ago was thought to be the limit of our capability has time and again been reduced. We admit there must be a halt somewhere, but just where this is going to be is uncertain, at least the end is not in sight.

Working Too Long.

The news comes to us that an eastern foundry has prohibited its molders from beginning work prior to 7 a. m. It appears that they have been in the habit of starting in about five o'clock in the morning, and as it is very seldom that we find the employer attempting to reduce the working hours from philanthropic motives, we must conclude that this form of working has been found to be without practical benefits.

To be frank, a man's capacity to produce does not occupy a direct ratio to the length of time he is engaged. It is true that the shorter the period is of his daily toil the greater is his output per hour, though we do not mean to say that he can accomplish as much in four hours as in ten, but there is a limit to the length of time that he should work daily in order to attain the greatest efficience. This is demonstrated throughout the world by the relatively low output produced by the workmen where the longest working day is in force. Strange to say, the average man does not realize that

by shortening his hours he is offering himself the chance to make the remaining time more useful. In other words, a couple of hours knocked off the working time and devoted to self-improvement may result in as great an output as formerly. Of course, everyone is not going to improve; there are always some one whose life outside of actual work is spent in sleeping and eating, but the experience of those employers who have reduced the working hours has invariably been that the men have showed a marked increase in output per hour, and in some cases actually accomplished as much or more in shorter hours than they did during the longer hours.

Nor do we need to go far from home in order to find a proof of this. Almost every locality has its foundry with the habit of prolonging its heats beyond the time limit. Was such a foundry ever known to receive a greater output per man than the ones in which regular hours are observed? There is a certain length of time that it is profitable to keep men working; when this is exceeded both quality and quantity of output deteriorates.

If foundrymen would spend as much time in determining how many hours would give the best results, as they do to other questions, there is but little doubt that the length of the working day would be materially reduced. In this connection, it may not be amiss to say that in the average foundry the molder is made to do a large amount of work which could be done equally well by a laborer, and by doing which the molder is hindered from appearing to the best advantage.

Why Co-Operative Concerns Fail.

In striving to obtain the ideal condition for the workers, co-operation among themselves is pointed to as a solution of all the troubles that infest society. Attention is called to the ability of employers to make fortunes by simply directing the energy of a number of individuals into certain channels, and the question is asked why the workmen could not themselves direct their own course and escape what they are pleased to term the caprices of an autocrat.

The spirit of rebellion rises at the mention of the word autocrat, and yet every successful business is ruled and carried on by the will of but a few. It takes a dictator to surmount obstacles, and co-operative concerns have failed by the absence of one, powerful enough to overcome the petty jealousies originating internally in co-operative concerns themselves. In repudiating the autocratic rulings of those who governed their actions when working for others, they have closed the door by which they could make a success by combining. Co-operation is entered into for the purpose of escaping obnoxious rulings, and every member feels that he is entitled to be handled with a soft glove. He will expect certain privileges never accorded him before, and if anyone should show any intention of grasping the reins and guide the efforts of all towards a common object he will promptly be sat upon as interfering with the shower of blessings that is supposed to follow upon the heels of co-operation.

There is no society that succeeds in any measure in which some individual does not stand out in bold relief above the rest. He cannot please all, nor does he try to. Too many cooks spoil the broth, and too many individuals acting as officers prevent any organization from succeeding. There is no manufacturing concern that is prosperous that is not led in the race for supremacy by an autocrat. There is no labor union that is in any way effective that is not headed by an autocrat. One man as good as any other man sounds very nice, but the fact remains that somebody must be captain. A regiment with every individual allowed to pursue his own way would be very ineffective in a battle, and the same holds good with industrial organizations, someone must lead. And this someone must be above his followers in ability and resources, and being so he will be an autocrat, pure and simple, whom it is impossible to sway.

There are but few workmen who can obey. Those incapable of obeying are equally unfitted to command. Working for others, the efforts of such a workman can be directed to the best advantage, or someone will be substituted who is more tractable. But let this man enter a co-operative concern and he instantly feels that he ought to be allowed to do what he thinks is best. This is what undermines co-operation. The efforts of individuals cannot be handled towards a common object without causing friction. He must bow to the will of someone or the organization will be disrupted.

Here is where co-operation fails. Nobody wants to obey—all want to be masters, or at least their own masters. Their lack of success is attributive to this, and they will continue to fail as long as each individual insists on taking a hand in managing.

The Small Shops.

The foundry business, in common with other trades, is passing through a general depression, and many a weak concern has passed to the great beyond. Strange to say, while the shops, representing the survival of the fittest, have been unable to obtain orders enough to operate their works to their full capacity, that others should have ventured upon the troublesome sea of foundrydom. Such is the case, however, and while the newcomers largely represent small concerns their appearance in such general times of distress has more than a passing significance.

We have witnessed in all lines a concentration of effort to reduce the cost of the product to the minimum. We have seen great combinations formed in other industries, having for their object the control of their respective markets, and while certain lines of foundry work have erected enormous works, in order to produce goods at the least cost, and succeeded admirably, still they are able to transact a sufficiently large volume of business only so long as they sell at a price below that at which the small shop is able to produce.

Items purporting to relate to some combination among foundrymen reach us occasionally, and we want to take this opportunity to say that it is as impossible to amalgamate the foundry industry of the United States as it is to make all of our citizens belong to one political party. With a large capital, a superior system and the most approved appliances a great shop may be able to outbid a small one, but it must continually exercise this prerogative to hold its trade.

Let the price of castings be advanced a small fraction of a cent and foundries will spring up like mushrooms in all directions.

A Western Round-Up.

The Fremont Foundry and Machine Company has a very important exhibit. Large patterns for casting railroad cars attract a good deal of attention. Christ Peterson, engineer at the foundry, shows his artistic genius as a draughtsman in an enlarged bible picture of King Solomon's Temple.—Fremont (Neb.) Tribune.

Well, why should it not attract attention? We have heard of casting steamboats, where they had to employ a man on horseback to light the vents, though we were rather inclined to doubt the actual occurrence. But if they can cast railroad cars in Nebraska why could they not cast steamboats?

Then we should like to have the Tribune explain to us what it means by saying, the engineer of the foundry. Does he run the railroad cars as fast as they are cast or is he a new official, that somebody else has got to respect. Please explain his duties besides enlarging pictures of Solomon's Temple. Has he got any connection with the foundry at all?

Among recent bids for castings we noticed the great disparity in the prices asked for a certain amount of castings by the Mechanics' Iron Foundry Company, of Boston, and the Co-operative Foundry Company of Lynn, Mass. The former asked 2½ cents per pound the latter 1 9-16 cents, a difference of 37½ per cent. It would be interesting to know the figuring by which these firms arrived at results, differing so widely.

A Taunton (Mass.) molder had his mind deranged by studying too hard over questions of religion. Curious, is it not, that we never hear of a molder losing his mind by thinking too hard of his own business.

Learning by Experience.

Three members of the commission appointed by the government to inspect the steel plants of the country with a view of obtaining information regarding the iron industries, met with an accident at the Carbon Steel Company's plant at Pittsburg lately.

The commission, together with several members of the Carbon Steel Company, were inspecting the plant and came to a furnace from which the fires had been drawn so that the furnace could cool. The party were standing at the furnace when one member struck a match and placed it inside the furnace door, so that they could see inside. The

furnace was filled with gas and an explosion followed.

Three members of the commission had their faces and hands burned and their hair and mustaches singed. The necktie of one of the men caught fire, and the clothing of others caught fire in several places.

(If these men had not been members of a commission would we have heard anything about it?)

Charles Fasnacht, foreman of the Lebanon Stove Works, Lebanon, Pa., sustained injuries through an explosion at the works which will probably prove fatal. A quantity of liquid iron was spilled in a pool of water, and the metal was thrown all over the foundry. Fasnacht was terribly burned about the head and body by the hot metal.

Kranks' Korner.

Employers of labor are wont to lay especial stress on the desirability of being located in sections where conditions, local or inherent, have made those from whom the ranks of labor are recruited so satisfied with their surroundings and the remuneration they receive that no organization has been possible among them. It is pointed to, as if it were a magnet, that freedom from demands of organized labor should be considered as an extra inducement to locate, and in itself offer added security against interruption.

* * *

Cheap labor has for years been a standing advertisement from the southern states. It has been held out as if it was something worth going after, and numerous factories have been located there, only to find that what had the appearance of being cheap labor was in reality dear labor. They have learned the truth, which ought to be in everyday evidence, that the cost of labor, considered by itself, without taking into account what that labor produces, is a most unreliable way of figuring. Wherever we find cheap labor its mate, low productiveness, is close at hand, ready to offset any apparent advantage.

* * *

A demand for increased remuneration will assert itself with an increase of ability to produce. Throttling this sentiment or refusing to heed it altogether causes a combination of individuals whose numerical strength in itself will tend to create a respect for the demands it may make. It is a noteworthy fact that the most productive labor through the world is the best organized. It is also conceded that this, the highest paid labor, is in reality the cheapest labor.

* * *

Low priced labor is no more of a factor in economic production than a low priced building site. The intelligence of labor can in all cases be looked for to make such demands as are consistent with its ability to contribute a greater share of a product. Labor remains cheap only so long as it is cheap, though dear to the one who purchases it, even if it does not contain either shop committee or walking delegate.

* * *

The new industry for casting edged tools will soon be in operation, when, if the material fulfills the promises, a new era in tools will be started. Much interest is shown among the farmers about plow points. If a point can be made that will stand a season's plowing, a wonderful point will be gained, and farmers made happy.—Wheeling Register.

* * *

Somebody is evidently trying to rope the West Virginians into a bunco game by shaking a patent mixture of cast iron in their faces. The same kind of people as are inventing rotary engines and other mechanical improbabilities take a whack at the metallurgical field occasionally.

* * *

Of all the "wonderful inventions" patented, it is curious that none are brought forward by men who have made the subject a study. A telegraph operator invents the "greatest" of engines, and "discovers" principles that engineers have never been able to see. A shoemaker brings out a dynamo with a power that all of our electricians cannot equal. Some farmer, who never melted anything outside of a pound or two of lead, proposes to disregard all established laws and furnish us with a mixture that is astounding.

* * *

It is the old story over again. Men fail to make a success in their own vocation and jump over to some other trade and propose to revolutionize existing methods. Whatever so-called improvement they claim to effect is based on a lack of knowledge in re-

gard to that industry which they are so anxious to help. It is one fault with the greatest part of humanity that they are always able to make suggestions to their neighbors, instead of to themselves. They know more about somebody else's business than their own.

Tubal's Meditations.

A bad casting is like a bad character. You can make many good ones, but as a man's evil habits, the bad castings always stand out most prominently.

The flask made of finished lumber, is not always the best to hold the sand.

A nervous molder is like a pattern without rapping-plates—a little hard usage knocks him all to pieces.

The molder that can work all day, and keep a clean face, thinks more of his beauty than his labor.

The man who calls the loudest for a lift, is generally the last man to come up and help his partner.

The molder whose confidence bubbles over like iron in a green ladle, is apt to meet his fate in grate bars.

The molder who is too proud to ask advice should be permitted to stop his own run-outs.

The molder that tucks his bars, after he lifts off the cope, is like the man who walked a mile out of his way in order to ride half the distance.

Alloys.

In his fourth lecture on alloys, delivered at the Mason College, Birmingham, Mr. McMellan showed by means of tables and curves, that the results of adding increasing quantities of one metal to another were variable. Thus, in brass, the addition of zinc to pure copper at first caused a somewhat irregular rise in the strength of the copper, until 20 per cent. of zinc had been introduced; then there was a slight falling off until the alloy of 30 zinc and 70 copper was reached. This was followed by a rapid increase in strength and the maximum was obtained with the mixture of 42 of zinc and 58 of copper, and after this the continued addition of zinc led to a sudden and strikingly marked decrease in strength, in toughness, and in ductility, the minimum strength occurring with the alloys containing from 69 to 70 per cent. of zinc, which were intensely hard and brittle. Bronze gave a somewhat similar curve, but the maximum strength was reached after the addition of 18 per cent, and the minimum strength after 32 per cent. of tin. Similar curves were shown for gold and aluminum, nickel and iron, and other alloys.—Practical Engineer, London.

New England Foundrymen's Association.

The regular meeting of the New England Foundrymen's Association was held at the United States Hotel, Boston, March 10th, 1897.

After the regular business had been transacted, Vice-President W. O. Barbour read by request the paper read by him at the last meeting, which was on the following topic, "What methods should be pursued to further the interests of this association, and to make it a source of definite profit and pleasure to its members?" W. W. Bird, of the Broadway Iron Foundry, Cambridgeport, Mass., then furnished an interesting paper, as an answer to the questions:

To obtain the best results in melting iron, what should be the percentage of tuyere area of the furnace? What is the proper pressure to the blast, and what are the effects of too little or too much tuyere area or blast pressure?

In reading the numerous circulars with regard to patent furnaces, center blast, etc., one is apt to be confused with regard to what it is possible to do in the line of melting iron and to think that something must be wrong either in one's methods or else in the other party's claims. Therefore before taking up the discussion of this topic it will be well to first consider the theoretical possibilities, as the best results certainly cannot be better than these.

The efficiency of melting like the efficiency of a boiler depends largely on the condition of waste gases; for aside from radiation, the only loss of heat after furnace reaches normal temperature is in what goes off in this way. The cause of this loss may be divided into three parts: (1) Incomplete combustion or corbonic oxide in gases. (2) Excessive temperature of gases. (3) Too much air.

The following table shows the number of pounds of iron possible to melt with one pound of ordinary coke under the various

conditions indicated. In making out this table no account is taken of the heat required to raise the temperature of the brick work or of the heat lost by radiation and conduction, nor of heat supplied by kindling wood in bed. As these quantities would be about the same the relative values would remain practically the same if these quantities had been considered.

The calculations are based on the following data. The temperature of iron is taken at 50° at beginning, 2600° at melting point and 2900° as it leaves furnace. The specific heat of iron .13 latent heat 253 heat units. This gives 603.5 as number of heat units required to raise the temperature of one pound of common cast iron from 50° to point of fusion and then 300° higher after melting it. Experiments have shown that iron which would be considered fairly hot is at a temperature of about 2900° as it is run into a ladle. The number of heat units per pound of coke is taken at 13,000; the temperature of air 50° and specific heat .237 and 12 pounds as necessary for the combustion of one pound of coke; the specific heat of coke .21.

5 per cent lack of air; that the best results whether with too little, too much or just right amount of air are obtained with the lower temperature.

The best results are to be obtained, therefore, by having air enough and getting low temperatures at charging door, and is accomplished to a certain extent by having the door as high as possible so that the gases in passing up from melting point will have a chance to heat up the subsequent charges before escaping. There is generally a loss, however, by the hot gases passing through the fuel of next charge and giving oxygen to the fuel carbon to form carbonic oxide which will burn later when it gets air.

After the charges are all in the temperatures of the gases increase as the last charge settles, while in the first of heat a considerable amount of heat is required to warm up the furnace itself, relatively greater the smaller the furnace, so the last results are probably obtained in the middle of heat.

Taking the ratio for ordinary practice in melting as 8, the amount of air required is

POUNDS OF IRON PER POUND OF COKE.

Temperature of Gases at Door...		400°	800°	1200°	1600°	2000°	2400°
Complete Combustion.....		19.8	17.8	15.8	13.8	11.8	9.8
Percentage of Coke or Carbonic Oxide....	10	18.4	16.5	14.6	12.7	10.8	8.9
	20	17	15.2	13.4	11.6	9.8	8
	30	15.6	13.9	12.2	10.5	8..	7.1
	40	14.2	12.6	11	9.4	7.8	6.2
Percentage Air Excess.....	5	19.7	17.6	15.5	13.4	11.3	9.3
	10	19.6	17.4	15.2	13	10.8	8.6
	15	19.5	17.2	14.9	12.6	10.3	8
	20	19.4	17	14.6	12.2	9.8	7.4

It will be seen from this table that the ratio of melting decreases at the rate of 1 pound per 200° increase in temperature of gases with complete combustion; that the ratio decreases more rapidly the greater the excess of air while with incomplete combustion or lack of air the ratio decreases less rapidly the greater the percentage of carbonic oxide; that better results are obtained by having too much air than by not having enough, but that this difference is less as the temperature of the gases increases, remembering that 10 per cent C O is the same as 1½ pounds per pound of iron or 16 to 18 cubic feet of air must be put in for each pound of iron.

Let Q be the number of cubic feet of air required, then Q equals A V T—where A is "area" of opening, V the "velocity" of flow and T the "time." The relation between T and Q depends on rate of melting, so that the necessary amount can be obtained by making area larger or smaller according to charge in velocity, which depends on pressure. Assuming the rate of melting, which must necessarily be limited by area of furnace, the amount of air needed can be found.

The real resistance to the flow of air is in the furnace opposite tuyeres rather than in the tuyeres themselves, as is shown by the blast gauge, which will vary during the heat due to the settling of bed while the revolutions of blower and tuyere openings remain the same, also in difference of blast between coke and coal.

It is desirable to carry pressure enough to get the air into center of furnace and well distributed through the fuel. Too much blast will carry fire higher and consequently give hotter escape gases beside burning out the lining more rapidly. But it must be remembered that while the blast gauge may show 8 or 10 oz. of pressure it does not follow that the air is going in, that is, with a centrifugal blower, as the pressure will not go above that corresponding to speed of blower, however, much the flow of air is decreased so that it is well to know the pressure with all the tuyeres closed and then open them so that the pressure is a little less. It is then certain that the air is going in to the capacity of blower.

An 8 oz. pressure seems to be sufficient for furnaces under 4 feet in diameter with increase of pressure for larger sizes. The ratio between tuyere and furnace area ranges from 1 to 4 to 1 to 20 in the various furnaces in use. The larger the tuyere area the more air up to the point where flow of air is limited by fuel in cross section of furnace itself, and consequently, the more rapid the melting; but different furnaces, having same ratio and blast, will not give same results as no two melters will have same iron and fuel, nor put it in the same way, so that the same pressure outside may give more or less in one case than in the other. Too rapid melting is apt to give slacker iron, but this of course can be changed by varying charges.

The conclusion is that furnaces melting 8 to 10 must have about the right proportions for method of charging used, that those requiring fuel 6 to 1 need looking after, and that those claiming 15 or 20 to 1 need watching.

Philadelphia Foundrymen's Association.

The regular monthly meeting of the Foundrymen's Association was held in the assembly room of the Philadelphia Commercial Museums, South Fourth street, Philadelphia, on Wednesday evening, February 3.

The meeting was called to order by President P. D. Wanner, after all present had been conducted through the departments of the museum, in accordance with arrangements made prior to the meeting.

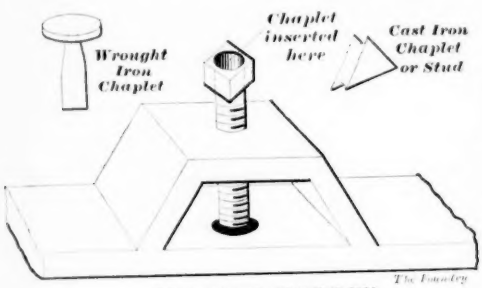
The reading of the minutes of the last meeting having been dispensed with, Secretary Evans reported for the executive committee as follows:

"Your committee take this opportunity to congratulate the members of this association on the permission obtained for holding their meeting at the Philadelphia Commercial Museums, where, under the guidance of Prof. Wilson, has been gathered together so many articles of commerce from different parts of the world in such a shape that they may be inspected and compared with our home product. Americans are looking forward for a sufficient amount of foreign trade to absorb the surplus of the products of field, factory and mill, and nobody can deny that our foreign trade is increasing at a rapid rate. The reason probably is that we have built new factories and mills and expanded the old ones beyond the home demand for products, and we are therefore forced to look for other markets. The Commercial Museum is probably doing more than any other one institution toward helping us to find a foreign market, and it therefore is worthy of the support of our people. The museum authorities not only find us markets, but also ways and means for making delivery of our goods. We can therefore see what an important institution we have in our midst. As far as the home trade for products of the foundry is concerned, we realize that the iron foundry is each year being driven into a smaller corner. For instance, almost all of the cast iron trimmings that have been used in the construction of freight and passenger cars have been replaced either by pressed steel, malleable iron, or cast steel, because those articles have been reduced in price to such an extent, and with them the weight, that the iron casting has been driven out of the market entirely. The same cause holds good in a number of other cases, and in the aggregate the market for iron castings is much reduced. We do not claim that the foundry business has improved of late, but we think there is a better feeling existing, and we believe that after the change in the administration and the advance of warm weather

there must be a change for the better. Prices are exceedingly low and money is hard to collect. We do not look for an immediate betterment, but we think it will come slowly and surely.

No report from the Price Committee was forthcoming.

The secretary exhibited a new chaplet holder which he said had been sent by Joseph Hennesey, with the Wm. H. Page Boiler Co., Norwich, Conn. Mr. Henesey, in a short paper, thus described his invention: "The device is very simple. Instead of sharpening 12 or more chaplets that require to be at least 5 inches to 6 inches long, my chaplet holder calls for a chaplet only 1¼ inches, with a blunt end. The device may be adjusted to fit almost any size of drag, the long side resting on the bottom board. My holder with a ¼ inch chaplet will hold a core that weighs 2,000 pounds. After the pattern is drawn out the chaplets can be set in the



CHAPLET HOLDER

holder in less than two minutes. The old style chaplet had to be 5 inches to 6 inches long, and had to be ground to a point, or drawn to a point at the forge. Now the chaplets come from the maker of the right length, and they are cheaper. There is no give to the chaplet after the core is set, so there is less danger of a chaplet leaking. The triangular chaplet can be used wherever you can gate a mold, and have the iron strike the chaplet when it first goes in, so that the sharp edges will melt. When the cast iron chaplet can be used it is set on top of the bolt, and there is no danger of failure. I use the cast chaplet in steam boilers that have to stand 200 pounds pressure. I would prefer a wrought chaplet in all cases but for work that does not have to stand any pressure the cast chaplet is all right."

The chaplet holder was handed round and thought to be a good invention for standard work, but hardly adapted for special work.

A letter from Thos. Devlin, a member of the association, was read, in which he suggested as a good topic for discussion before the association the excessive freight charges on coal to Philadelphia, which he stated were about as high as to New York, and in proportion to distance about four times as high as to Chicago. He also spoke of the need of a mutual fire insurance association for foundry and machine shops only. The stock companies he intimated had run up the premiums for insurance upon this class of risk, and foundries were now paying, as he believed, excessive premiums. The communication was, on motion, referred to the next meeting.

Guy R. Johnson, general manager of the Embreville estate, Embreville, Tenn., then read a paper entitled "Chemical Hints to Foundrymen:"

A year ago, at the Pittsburg meeting of the American Institute of Mining Engineers, the writer had the pleasure of listening to a discussion on the physics of cast iron.

The following paper is a direct sequence, and will, it is trusted, throw some additional light on the question of the relation of the chemistry of cast iron to the physics thereof; the idea being to help out the foundrymen who cannot afford the services of a chemist, and to place before them in a succint shape the results of over 300 physical tests and over 1,000 analyses.

The value of the subjoined notes is necessarily weakened in some degree by the fact than only one iron—viz., Embreville—has been experimented on, and that, further, a year is a short time in which to obtain a great deal of information on so vexed a subject.

Per contra, it must be said that the ores at Embreville give almost any range of any element found in cast iron, and that being worked entirely by chemical analysis, as the furnace at Embreville is, there is an almost infinite variety of demands as to chemical analysis.

Further, the writer has had much valuable information from various customers, and has been especially fortunate in having the services of so capable a chemist and well informed man as George F. Eldridge, who has

had charge, under the writer's supervision, of the experiments from which the following results are deduced.

For the sake of better understanding, it will, perhaps, be better to take up the elements and their effects on iron seriatim, beginning with carbon, which, the writer does not hesitate to say, has more influence on the physical characteristics of cast iron than any other, for to a large extent, as indicated below, and within certain limits, the influence of the various other elements is exerted, not on the iron itself, but on the carbons.

Chemists tell us that there are four forms of carbon present in cast iron, but only the two best known forms—i. e., graphitic carbon and combined carbon—will be considered here. In the total carbons in the same iron there is not a great variation, but the results of the relative amounts of the two on the strength and appearance of the same are enormous. The higher the carbon the weaker the iron, and it is this fact that makes charcoal iron so strong. The following are average analyses of a well-known charcoal iron and an Embreville iron of the same chemical composition except as to carbon:

	Charcoal Per cent.	Embreville Per cent.
Silicon	1.69	1.11
Sulpher	0.060	0.083
Phosphorus	0.364	0.303
Manganese	0.50	0.50
Combined carbon	0.89	0.75
Graphitic carbon	2.32	3.02
	Pounds	Pounds
Tensile strength	35,000	30,300

It will be noticed that the silicon is about ½ per cent lower in Embreville iron. To neutralize this and obtain the same tensile strength the phosphorus must be lowered, and accordingly we find:

	Embreville Per cent.
Silicon	1.55
Sulphur	0.068
Phosphorus	0.185
Manganese	0.50
Graphitic carbon	2.94
Combined carbon	0.83
	Pounds
Tensile strength	28,300

The following analyses show in a general way the difference in grades and carbons:

	Graphitic carbon. Per cent.	Combined carbon. Per cent.
No. 1	3.80	0.10
No. 2	3.78	0.25
No. 3	3.60	0.39
Gray forge	3.00	0.70
Mottled	1.50	1.70
White	0.10	3.10

Graphitic carbon renders an iron soft, easily machined and less apt to be brittle, but, owing to its disturbing continuity, decreases tensile strength.

Its disturbing continuity arises from the fact that it is simply an inter-molecular mixture, and not, as is the case with combined carbon, a true chemical combination.

From the above it follows that an iron high in combined carbon will be machined with more difficulty, will have greater strength, but will be more brittle. To cite familiar cases:

A locomotive cylinder has to resist great wear, must be of great tensile strength and density, and yet be capable of being machined properly. As we might expect, an iron having a No. 3 or gray forge fracture is employed in the best practice. For ordinary castings, however, a much softer iron is preferable, and accordingly we find Nos. 1 and 2 being used in such work, and being mixed, of course, with other grades and scrap as suits the idea of the foundryman.

It is not difficult to transform graphitic carbon into combined carbon. Chilling has this effect, and the remelting in the foundry, combined with the chilling of the sand mold, generally produces the desired grain; while by using metal chills and sufficiently low silicon contents all of the graphitic carbon will be changed to combined carbon, giving a white iron. Sufficient repetition of remelting, with the consequent loss of silicon, will make a perfectly gray iron white. In malleable work an air furnace is used to produce this effect on the first melt, though in this class of work the process is carried further and more of the carbon is burned off.

Silicon.—The effect of this element on cast iron is probably better known than any other occurring therein. Its proportion varies all the way from a small fraction of 1 per cent.

as in white and basic open hearth irons, to 17 per cent or over in ferrosilicons. Its influence on foundry irons is that of a softener—i. e., it tends to turn the carbon in the iron into the graphitic state. Just what its influence per se on iron is it is impossible to say, owing to its great power over carbon, from which it is impossible to disassociate it. It is probable that its effect is to weaken, but with the ordinary run of carbons up to 1½ per cent. seems to make little difference, although it will be observed that the strongest iron in the tables is the lowest in silicon. It will also be noticed that the sulphur is comparatively high, quite enough to transform much graphitic carbon into combined.

Sulphur.—This element turns graphitic carbon into the combined state, and hence makes cast iron harder, denser and more liable to crack. The hotter the iron the lower the sulphur, and hence the graphitic carbon. From this it follows that Nos. 1 and 2 foundry have little sulphur, and it is a fact that they frequently contain less than 0.01 per cent, while a No. 3 or gray forge from the same furnace will frequently run well up toward 0.1 per cent, and white iron with over 0.3 per cent is not unusual. Such iron is usually as brittle as glass. Owing, however, to the above mentioned characteristic, that sulphur has a tendency to convert graphitic carbon into combined carbon, it is valuable in certain classes of foundry work, and an iron to show great strength and density should contain from 0.05 to 0.075 per cent or even higher, this being a point which can only be obtained by careful experiments on the iron being used. For instance, referring to table No. 4, it will be seen that 0.141 sulphur gives the highest as to tensile strength, while the iron resulting is "close gray." The outer skin of this specimen was hard to machine, although after this was turned off the iron cut more like steel than cast iron. An other case in point is Finnspong gun iron, analyses of which show from 0.09 to 0.150 per cent. For ordinary castings, however, it is best to have the sulphur as low as possible.

It should not be forgotten in this connection that coke contains a relatively large amount of sulphur, that iron readily takes it up, and that, consequently, many a ton of castings is spoiled through neglect to have the sulphur contents of the coke analyzed either by the user of by the manufacturer. For the same reason, much pig iron is annually condemned where the fault lies with the coke with which it is smelted in the cupola. When it is remembered that the best coke made in America contains about 0.5 per cent of sulphur, and that most of it carries upward of 1 per cent, and when it is further recollected that 0.1 per cent in the castings will generally make them too hard, it will be seen that the importance of coke analysis can hardly be overestimated.

Phosphorus.—According to Vosmaer, phosphorus has a tendency to convert graphitic carbon into the combined state, but owing to the greater effect of silicon and sulphur its influence is not so marked. Its value to the foundryman lies in that it promotes fluidity and helps to overcome shrinkage.

For this reason light thin castings should be made of high phosphorus iron—i. e., 1 to 1.25 per cent, or even higher—while strong castings should not contain over 0.5 to 0.6 per cent, and chilled car wheels not over 0.3 to 0.4 per cent. Iron containing less than 0.2 per cent is apt to shrink badly and to be red short; it is, however, especially suitable for malleable work and for mixing in the foundry with higher phosphorus irons to obtain a strong mixture.

Manganese.—Like sulphur, manganese has a strong tendency to convert graphitic carbon, and is therefore a hardener; but as most irons have not a great deal of this element in their composition, generally less than 1 per cent, not much attention has been paid to it, not as much as there should be, for owing to its affinity for sulphur it serves in melting in the cupola to carry off much of this element, which would otherwise combine with the iron, and it is well known to some foundrymen that in a cupola iron loses its manganese by combination with sulphur, the sulphite passing off in the slag.

Its presence is desirable in iron for making chilled castings, up to 1 per cent, and possibly a little beyond, but high manganese is not liked in ordinary foundry work, because castings containing much of it are sure to be brittle or even white. An illustration of this hardening effect was recently had at the Embreville Furnace.

A customer desiring a malleable iron containing over 2 per cent of manganese, it was

accordingly made, but while the iron was by fracture all No. 1 and No. 2, with silicon contents from 1.50 to 2 per cent, yet the chilled pieces, cast for the laboratory, were so hard, unless special attention was paid to cooling them slowly, that they could not be drilled.

ANALYSIS OF IRON.

	Per cent.
Silicon	1.50
Sulphur	0.012
Phosphorus	0.177
Manganese	2.57
Fracture	No. 1

Of course Hadfield's manganese steel is familiar to every engineer.

To sum up.—If ordinary soft—i. e., gray—castings are wanted use graphitic iron, low in sulphur and manganese, but reasonably high, say 0.75 to 1 per cent, in phosphorus.

If a strong machinery casting is wanted use an iron of close No. 3 to gray forge fracture, silicon from 0.80 to 1.00 per cent., sulphur from 0.03 to 0.05 per cent, phosphorus from 0.35 to 0.50 per cent.

For hydraulic cylinders, etc., use the same composition as above, but let the sulphur run from 0.075 to 0.110 per cent.

For chilled wheels the iron should analyze about as follows: Silicon 0.5 to 0.8 per cent, sulphur 0.02 to 0.04 per cent, phosphorus 0.20 to 0.40 per cent, manganese 1 per cent, fracture preferably No. 3 or close No. 2.

In this connection, it ought to be stated that while silicon seems to be the governing element in chill iron, at the same time phosphorus has its effect, as before noted, in changing graphitic carbon to combined carbon.

The difference, however, between the chill fracture of a low phosphorus iron and that of the same silicon high phosphorous iron is quite striking. In the low phosphorus iron the white or chilled part extends down into the gray portions of the castings like fingers, while in the high phosphorus iron the line between the chilled and gray parts is markedly straight. It is this interlacing that renders the low phosphorous iron so much more valuable for making car wheels, chilled rolls, etc.

One word ere the close of this paper on the subject of test bars. The controversy over the shape, size and results given of test bars has raged for the past few years throughout the land.

If the views of the writer are correct, it would seem to indicate that the advocate for each size is correct, or incorrect, in direct proportion as the size of his test bar approximates that of the castings, especially in regard to thickness.

By many the ½-inch bar is condemned as giving too high results. This arises simply from the fact that, being small, the iron is quickly chilled, and the casting contains much combined carbon, thereby promoting its density and tensile strength. If, therefore, castings ½-inch thick are to be made, by all means use the ½-inch bar; preference in all cases being given to round bars as most apt to give regular results, owing to synchronous cooling, which cannot be present when there are four corners, at which the cooling must necessarily start.

The writer feels inclined to insist on the foundryman's requiring—when buying iron—analysis as well as fracture, for the simple reason that no man can tell anything about the composition of an iron by looking at it. As fine looking No. 1 as has ever been produced has proven on analysis to contain less than 1 per cent silicon, while irons that were apparently close grained mill irons with less than 1 per cent of silicon will contain over 3 per cent.

In such cases sulphur is apt to be the element causing the closeness of the grain, and 0.04 to 0.05 per cent of this element will produce this effect. A usual effect of this element is found in a deeply pitted face.

Either of the two types of iron just mentioned will make, if melted alone, close castings, hard to machine but taking a capital finish, while the tensile strength of both will be low.

In short, the conclusion irresistibly forced upon the writer by the results given is that, to paraphrase an old story, there is no bad iron, but some iron is better than others.

Every iron has its use, and if our foundrymen will make up their minds to buy on analysis as well as fracture, and will further watch their coke with more care, there will be fewer losses and far more regular results.

(The author concluded his paper with numerous tables of tests made upon Embreville iron. Anyone wishing to obtain these should make application to Guy R. Johnson, Manager Embreville Estate, Embreville, Tenn.)

Discussion on the paper was deferred.

Secretary Evans: "We have a treat before us to-night in an address by Prof. Wilson, who has so kindly entertained us here to-night, on the objects of this institution. I have much pleasure in introducing Prof. Wilson, and we will now proceed to the bureau of the museum, where preparation has been made for our visit."

The assembly then proceeded to the bureau, where Dr. Wilson made a lengthy address.

He said: "The idea of this institution is to develop a Bureau of Commerce. There are various institutions of the kind in Europe which have sprung up within the last 18 or 20 years, in Brussels, Berlin, Paris, Vienna and other cities, and one or two in Japan—the latter perhaps coming nearer to our idea than any of the others, the Japs being quicker to push an enterprise of this kind han any other nation. The raw products seen here are simply an attempt and a beginning to bring together here the raw products of other countries, and by the aid of a scientific bureau we hope that many raw products not now available, and perhaps not discovered may be introduced to the notice of manufacturers. This institution began its work in 1893 at the close of the Chicago exhibition, and are indebted to that exhibition for a great many of our exhibits. Since that time we have been working with great vigor in Mexico, South America and Europe. The institution was organized with a governing board which includes a number of prominent Philadelphians. The board is absolutely non-partisan in every way and has nothing to do with politics. The object of the institution is solely to increase trade, and especially foreign trade. It has been the idea of our promoters to form a general bureau of information, not only for Philadelphia, but for the whole of the United States; therefore in the earlier stages advisory boards were organized, which now number over 120 Chambers of Commerce throughout the United States, and these have representation on our board. That was in order that we might touch every interest in the country. Finding we must seek information very exhaustively in foreign countries and go minutely into the details we early began to introduce ourselves in the same way to all foreign Chambers of Commerce. We are at present connected with about 40 foreign chambers. Caracas in Venezuela has the first representation on the advisory board, their president and secretary being elected as members. The other chambers were admitted in the same way. Materials were sent to us in large quantities with specific data covering the wholesale prices, discounts, and every condition of the trade, and all questions have been worked up by experts. We have been furnished with complete lists of the business houses in the cities of different countries, and they are here on our files for your inspection at any time. As an illustration, we could give you the names of all who handle hardware in Caracas, Venezuela. In the United States we have about 250 representatives on the Advisory Board. We have special agents in different sections of Europe, notably England, Germany and France, and we have been able to obtain the catalogues of the various manufacturing concerns of England, with their list prices and discounts, covering all the material coming to this and going to other countries. You can see at once the advantage of that. We have in a room adjoining this over 800 catalogues of recent date touching hardware, iron and all the industries of England. We are also in possession of more than a thousand catalogues from Germany and France, collected in the same way. This is one of the first methods of our work, and they are all so arranged and indexed that we can turn to any particular line of trade with ease. Through a variety of sources we have been able to obtain nearly all the government publications of the different countries, and these cover surveys, geological surveys, statistical reports concerning trade, and other matters of value. We get the trade publications of all foreign countries just as we get our own, published in every language. We have also all our consular reports and have a staff of 12 to 15 people who are reading them and placing them on our card files, and we thus make our own consular service of value, which hitherto was not made of value. As an illustration, a recent report from the consul of a foreign government came into our hands, concerning the railroads and the use of iron and steel in Japan, and containing many illustrations and photographs. We immediately took account of the information in the report and sent it to people in this country interested in railway material. This is

only an illustration of what we are doing in all lines of industry. We have recently asked the governments of the different countries where we are represented to send us all invitations issued for tenders for contracts for railroads, bridges, buildings, and we have received many satisfactory answers and already received notices of tenders required in Australia, Venezuela and Costa Rica. I give you these illustrations to let you see how we are branching out in the direction of a bureau of commerce national in character. We have systematized matters so that we can serve the business interests inside as well as outside of the city."

Continuing the professor described the sources of funds for carrying on the work, and urged all his hearers to use their influence with state and national legislators towards obtaining grants towards the maintenance and extension of the institution.

Mr. Green, who has charge of the bureau, then practically demonstrated the system of compiling and disseminating information, his illustration having a bearing upon the iron trade in all its branches. There were no charges made for information imparted other than for such clerical work as was necessitated, he explained, and all seeking foreign trade are invited to make use of the institution.

Pittsburg Foundrymen's Association.

The meeting held by this association March 22 was a representative gathering of the most prominent foundrymen of Western Pennsylvania. It was presided over by the president, Robert Taylor.

Following the transaction of routine business President Taylor welcomed the visiting foundrymen, explaining the purpose of the association, and inviting all to active membership. The regular program being taken up, John A. Penton, editor of THE FOUNDRY, read the following paper, on "The need of a Better Organization Among Foundrymen:"

Writers and speakers are fond of referring to this as an age of organization and concentration. The assertion is true, but the implication is false. All the ages of civilization have been ages of organization and this differs from its predecessors only in the fact that steam and electricity have enlarged the geographical limits of unity, making possible to the people of a state a closer association than, in other times, was given to those of a city, and to those of a nation a degree of unity not attainable by the inhabitants of a province without the aid of these agencies. Organization has enlarged its scope, but it has not changed its nature, its objects or its potentialities. Civilization itself is organized intelligence, and every progressive instinct in the race finds its expression in some new combination for the attainment of mutually desired ends.

The time-defying pyramids of Egypt stand as a monument to the effectiveness of concentrated effort, offering testimony to what may be accomplished by the combined and properly directed energies of thousands, turned to the accomplishment of one given object. The land of the pyramids furnishes, too another lesson of similar import. It was there that the brickmakers combined and won the first strike recorded in history, when their masters took from them the straw necessary to their business, and still required the same output.

Coming down, in our search for striking precedents, to times much nearer our own, we may point to none whose results have been more far-reaching or more prolific of lasting good than those of the ancient London guilds, which played so large a part in events which gave the first impetus to the spirit of Bri. sh trade. From their inception, they wielded an immense influence in shaping the history of their country, which may almost be said to be the later history of trade, so closely is it interwoven with every movement in the development of modern commerce. These guilds were nothing more than associations of the representatives of the different trades, and it is more as the result of their consolidated experience than from any other cause that British manufacturing establishments and British products began at an early date to invade the markets of the world, and laid the foundation of a foreign trade that still withstands the combined onslaughts of the other nations of the globe.

It is to these, and to the larger organizations that have succeeded and supplanted them, that Great Britain owes the commercial supremacy she enjoys to-day. One need go no farther in search for proof of this than his newspaper will carry him, to discover how sensitively responsive is the British parliament to the sentiment of British Chan-

bers of Commerce and British Boards of Trade. Administrations at Westminster always have their ears to the ground to catch the first indication of what the great commercial bodies regard as necessary in the way of legislation to aid the foreign trade, while it is no less solicitous to learn the wishes of the huge labor combines as to conditions at home. No man can be so blind as to believe that cabinets and parliaments would be so attentive to individual voices or so unreasonable as to imagine that similar results might have been attained without complete and thorough organization. It is to the representatives of large bodies, acting in harmony, that lawmakers listen, and it is organized effort, too, that secures advantages outside the realm of legislation.

It may seem to some that I wander from my theme, but, my friends, thousands of tons of foreign-made castings are coming annually from across the ocean to our sister republics in South America. They come in mining, milling and machine shop supplies, in agricultural implements and in other forms in which the American fundryman yields precedence to no competitor, and if we ship to one of these countries anything, from a brake-shoe to a Corliss engine, it goes by way of Liverpool, because the organizations of English merchants and manufacturers have forced the encouragement of foreign shipping, even to the extent of heavy government subsidies to transoceanic lines.

And this brings us down to the needs of the foundrymen. The necessity for closer association and the mutual helpfulness of trade organizations must be conceded by every man with sufficient intelligence to note the course that is followed wherever men have risen above a semi-barbaric state. Both for the accomplishment of specific purposes and for the general improvement and education of their members, trade organizations have a value well-nigh inestimable. There is only one man to whom such organizations are not necessary, and he is the man who knows it all. There may be an unusual number of such fortunate persons among foundrymen—men who have nothing to learn and fear that some of the valuable and exclusive information they possess might be absorbed by their rivals if they attended such gatherings as this. But it is a very wise man who can learn nothing from his competitors, and even that man who has the feeling referred to might stumble upon some unaccustomed and valuable idea through association with his fellows. He would consider it a reflection upon his business ability to intimate that they could not get value received in commercial dealings, and can hardly be said to compliment himself in fearing that he might not do as well in such interchanges of ideas and experiences as these gatherings foster and encourage.

The only reasonable theory upon which the lack of close organization among foundrymen in the past may be accounted for is that the fierceness of competition has bred distrust and suspicion. But that very competition breeds also a new unity of interest. It is through such associations as this that the roughest corners are to be smoothed away. As men engaged in similar lines of industry mingle together they discover that it is "the trade"—the man who buys their goods—that is knocking their heads together and urging them on to profitless conflicts, and means for overcoming some of the difficulties which confront the individual are laid open to the mass. Not only will an association benefit its members along the lines suggested, but a moral obligation to protect them in certain ways also exists.

I have more faith in associations of men whose lives are spent in similar lines of activity to secure by unity of effort prosperity for themselves, for their employes and for the country than I have in all the combinations of politicians whose horizon is bounded by party advantage on the one hand and pocketbooks on the other. If this great country of ours, whose marvelous resources we never tire of proclaiming, and whose rapid progress has been due, thus far, more to those resources than to all other causes is ever to take the place destiny designed for it, the foundation for such material prosperity must be laid right here!

To this and similar organizations in other lines must we look for the planting of the seed that shall grow into a widespread sympathy, a universal co-operation and a more general understanding of what is needed to prevent our industries from falling into periods of depression as that from which they seem to be just now slowly emerging. If we can get men to give a portion of their time to considering together the best methods of overcoming this or that obstacle that

presents itself to each—how best to estimate the cost of castings, how to avoid trouble with workmen, how to reach new markets—we will be doing a grand work, a work in which each must receive benefit from his fellow and give something in return. The meetings at stated intervals, the quiet talks over foundry problems, the discovery of remedies for evils we have been unable to correct alone, and the inevitable growth of mutual confidence and respect that follows all this—these are the results which make organization imperative at a time when all those with whom we have to deal are banded together in one way or another as the peculiarities of their pursuits seem to dictate.

Prominent foundrymen have lived and carried on business in the same city for years, only to meet and become acquainted for the first time at such gatherings as this, and have been surprised each to discover that the other had neither horns nor hoofs. Through such meetings they have found ways of mutual helpfulness, and have accomplished the saving of energies hitherto expended in purely gratuitous exercise of fighting each other through sheer prejudice.

If we go still further and join and take part in the deliberations of the national body in this or any other line we only widen by that much our sphere of usefulness to ourselves and our associates. Local and state bodies are properly the feeders to the wider organizations, and, while they serve well in their own fields, it is to the greater associations that we must look in critical periods and when trade emergencies arise. We meet men of note in the business and make a part of their exceptional experience. The man who could find no benefit from such meetings would not be improved by any earthly agency. I know personally several men who have declared themselves well repaid in dollars and cents for the time and money invested—and I use the word invested advisedly—in attendance upon the meetings of the National Foundrymen's Association in Philadelphia last May, while the pleasure and intellectual profit of the event stand as extra profits. I have in mind one well-known foundryman who saw there an original appliance which filled a long-felt want in his establishment, and who immediately adopted a modification of it fitted to his peculiar needs, thereby effecting a saving and an improvement in work which he had long contemplated vainly.

Still one step farther and we arrive at the national association of manufacturers, which is but a logical sequence of the local organization, and whose benefits supplement those of the latter.

It is now only a few years since the first foundrymen's association in America grew out of a preliminary meeting at which less than half a dozen men were present and already—through the interchange of ideas and the spread of information—more good has come to the business than in all the previous history of founding in this country. Nor has the benefit been confined to this continent. The papers read and the discussions carried on have been published in many languages in the trade journals of other countries, while we in turn have profited by similar movements abroad. There were skeptics at first. There may be some still. There are always men who are slow to accept any new idea, but sooner or later they must acknowledge the value of the work that has been done and in the end be compelled, like those who persecuted Galileo for declaring that the world was round, to acknowledge their error. It is certain that only those who have tried the experiment of organization, who have associated themselves with their fellows and felt the benefits of such association are competent to pass judgment.

This idea has grown and spread and will continue to do so. There are now several bodies in various sections of the country meeting and working as you are, with the same inspiration, the same aims and the same incentives. Their influence is being felt in every foundry in the land and must continue to be a growing power.

Those who fearlessly take the initiative in such matters, sometimes get less credit than they deserve when success has crowned their efforts. As in the parable of the workers in the vineyard, those who come in at the eleventh hour get as large a wage as those who toiled through the heat of the day, but to the wages of the latter are added a personal satisfaction and a consciousness of duty well done, which are full compensation for their extra toil.

If business men and manufacturers in general and foundrymen in particular could be persuaded to see where their true interests lie and to seize every opportunity that pre-

sents itself to co-operate willingly and heartily for the common good they would be able to exert an influence of inestimable value.

Surely no more laudable or patriotic work could enlist our sympathies than to place our business on a basis ensuring steady and remunerative labor to the toiler and reliable work to the consumer, and none could redound with greater glory to our country and its welfare.

Mr. William Bradbury, of the Anzhutz-Bradbury Co., who is one of the oldest foundrymen in Pittsburg, and who was closely identified with the earliest organization established by the molders of America, followed in a reminiscent strain, telling of the difference between the shops of to-day and those of his boyhood, his connection with foundries reaching back nearly half a century. In speaking of the advancement which had been made, Mr. Bradbury noted what appeared among the possibilities of the future. He recommended a free interchange of ideas as doing more towards a general improvement of the trade than anything else.

Thos. D. West, of the T. D. West Foundry Company, Sharpsburg, Pa., was a central figure, and constantly surrounded by his many admirers. In a neat speech he told of the benefit the organization had already conferred upon its members, and urged the necessity for a closer relation between manufacturers engaged in the same trade.

Obituary.

Charles Eddy, founder of the Eddy Stove Works, Troy, N. Y., died at Newfield, Ct., March 19.

William G. Lambert, Sr., a member of the firm of Lambert Bros. & Co., of Ironton, O., proprietors of the Olive Foundry & Machine Shops, died at his home in that city on March 17, at the age of 55 years.

Mr. Henry F. Hoge died at Evansville, Ind., March 14. He was 58 years old. The deceased was president of the Evansville Foundry Association, and was also connected with several other associations.

Mr. William Burnett, an old resident of Chelsea, Mass., died at his home, 69 Eleanor street, March 10. He was for many years foreman of the Highland Foundry in Boston and had lived in Chelsea thirty years or more.

John Carter, of Niles, Ohio, for years well known in iron circles, died March 23. Mr. Carter, until ill health compelled him to retire, was manager of the Globe Foundry & Machine Works, and was interested in other enterprises.

Elnathan B. Frisbie, a well-known and highly-respected resident of Chicopee Falls, Mass., died there March 15 after an illness of about a month. He was 60 years of age. Mr. Frisbie had been employed by the Lamb Manufacturing Company for many years and at the time of his death was foreman of the foundry department.

Daniel Walker died at his home in Braddock, Pa., March 8, of heart disease. He was 67 years old and was born at Buckley Hill, Lancashire, England. His father was for many years in business at Pittsburg. Mr. Walker spent nearly thirty years in mills in Georgia and Alabama, being a molder. For several years he had been superintendent of the foundry of McVay & Walker, his brother, Thomas, being a member of that firm.

Gustav Abrams died at his home in Hutchinson, Minn., March 1st, of consumption, aged 54 years. He was born in Omal, Sweden, February 3, 1843, where he lived until coming to this country in 1879. In 1883 he, in company with two others, built a foundry at Dassel, Minn., but sold out and came to Hutchinson in 1886. Upon coming to Hutchinson he entered the employ of the Sumner Mnfg. Co. Mr. Abrams had taken out several patents on different classes of machinery and was actively engaged up to the time of his death.

Henry Ruhland, a retired iron manufacturer of Philadelphia, died on March 11, at his home, 3217 Diamond street, in that city, at the age of 55 years. He was born in Hesse Cassel, Germany, and came to this country when 16 years old, learning the iron molder's trade at Royers Bros.' foundry, in Philadelphia. In 1867, with his brother Frederick, and with Godfrey Rebman, he started the Girard Iron Foundry, at Twenty-second and Master streets, Philadelphia, which enterprise was highly successful. While retaining an interest in the foundry, Mr. Ruhland retired from active management of its affairs some years ago.

EVENT OF THE YEAR.

Coming Convention of the American Foundrymen's Association.

Preparations Being Made for the Most Successful Meeting Ever Held in the Interest of Foundrymen.

The American Foundrymen's Association will hold its annual meeting in the city of Detroit May 10th, 11th, 12th and 13th, and it is naturally expected that under all the circumstances a much larger attendance can be looked for than were present at the meeting held in Philadelphia last year.

This is owing to the fact that the organization is now an assured success, having received about five hundred applications for membership, besides Detroit is more centrally located for a gathering of this sort than Philadelphia could possibly ever have been.

Added to this, the fact that the Stove Manufacturers' Association and the Stove Founders' National Defense Association will both meet in Detroit the same week, it can be readily seen that the committees having the matter in charge have some good reason for believing that the foundrymen of the country generally are going to avail themselves of the very low rates offered by the railroads to visit the City of the Straits. Reduced rates have been secured from all parts of America, and the hotels of Detroit have also granted some unusual concessions.

The foundrymen of that city have gone to work in an energetic manner to entertain their guests, and at a meeting held some months ago Mr. John R. Russel, secretary of the Russel Wheel & Foundry Company, was made chairman of the general committee. Since that time he has appointed the following sub-committees to have charge of the work of taking care of those who are sure to be present:

Finance Committee—Harry S. Hodge, Clarence Carpenter, James Dwyer, G. N. McMillan, George H. Barbour, J. G. Lobenstine, Johnston Stuart, Oliver Phelps, Thomas Murphy, Neil McMillan, E. A. Sumner, R. C. Faulconer, T. S. Christie, A. A. Parker, J. M. Dwyer, Lafayette Crowley.

Entertainment Committee—Thomas H. Simpson, C. A. Ducharme, B. W. Parker, Wm. H. Dwyer, George W. Cope, W. Howie Muir, F. A. Goodrich, James W. Weldon, E. A. Wales, F. B. Stevens, W. F. Jarvis, E. E. Mann, James Inglis, Wm. A. Dwyer, E. S. Barbour 2d, F. W. Hodges.

Reception Committee—W. J. Keep, H. M. Leland, Chas Stuart, Jas. H. Springer, D. D. Buick, G. B. Gunderson, John O. Campbell, Duncan Symington,, Jeremiah Dwyer, C. B. Calder, J. G. Johnston, J. B. Wilson, John Smith, Jr., W. S. Russel, R. H. Fries.

THE FOUNDRY is going to make a special effort next month to inform all of its readers fully as to the particulars and details of the convention, as far as they have been perfected, and in doing so will take advantage of the opportunity of changing the date of publication to the 1st of the month, consequently it will appear on May 1st, in order that all its readers may be fully advised as to the convention before leaving home.

This will be a very handsome edition, profusely illustrated and containing a great deal of matter that will not only interest those who visit this city, but foundrymen at large.

Among the various matters that will be discussed will be the necessity of the adoption of a universal apprenticeship system that will be suitable for the demands of the foundry business, and containing special provision for the various branches of that business, and this subject is now in the hands of a special committee, appointed by President Schumann, who are expected to meet and make a special report. This committee will consist of C. S. Bell, of C. S. Bell & Co., Hillsboro, Ohio; R. Viall, of Brown & Sharpe Mfg. Co., Providence, R. I., and Wm. Ferguson, of the Gates Iron Works, Chicago, Ill.

Another committee, consisting of Wm. Pfahler, of the Abram Cox Stove Company, Philadelphia, Pa.; Wm. Yagle, of Wm. Yagle & Sons, Pittsburg, Pa., and E. H. Putnam, of Chattanooga, Tenn., will meet in Detroit previous to the convention to prepare a plan and report on the advisability of forming a defense association within the lines of the American Foundrymen's Association, that will protect its members from the in-

conveniences inseparable from labor troubles. Every foundryman who can possibly get away should endeavor to participate on this occasion and be present at this meeting. Hundreds of prominent foundrymen from all parts of America will be present, and the opportunity of meeting, exchanging ideas and making the acquaintances of the brightest minds in the business will be greatly enhanced by the chance it will afford to visit Detroit at a pleasant season of the year and participate in the pleasures that are being arranged for by various committees having the matter in charge.

Correspondence.

Editor The Foundry:

My experience with cast iron tools for lathe use dates back ten years or more. At the time I was making car wheel chills in the foundry of the Louisville Car Wheel Co., Louisville, Ky. I had the cast tools to make for the chill turner, and if ancient patterns be a criterion for long use, I should think they had been using them for several years previous to my working there. If I am not mistaken, there was a patent secured on a special cast iron tool for turning car wheel chills by a Louisville mechanic.

C. W. HOPWOOD.

Jeffersonville, Ind.

Editor The Foundry:

I have read with considerable interest the articles by Mr. S. S. Knight in the last two numbers of THE FOUNDRY, and while agreeing with him in many respects, there are some statements and theories of his with which I am not entirely in accord. First, in regard to the condition of sulphur in pig or cast iron. No standard work on metallurgy I have seen makes the statement that sulphur has been found in the form of a sulphate in any cast iron which was free from slag. Even in the mechanically mixed slag the great bulk of the sulphur is present as a sulphide. The non-volatile sulphur he refers to is usually called the insoluble, or better, the residual sulphur. In working pig iron residues for sulphur, though sulphur present as a sulphate would be soluble, the insoluble matter only is examined. Some hundreds of determinations made on the residues from one brand of pig iron gave about .005 as the average insoluble sulphur of that brand. Mr. Knight's theories in regard to phosphorus in iron are certainly new. Whether they are correct is a different proposition. He offers no proof of the existence of his phosphides, but merely assumes two kinds, the one occurring in soft, the other in hard iron, and proceeds to give them specific gravities to fit his theory. Mr. H. M. Howe, in his Metallurgy of Steel, page 55, says: "In ingot metal phosphorus exists chiefly, if not exclusively, as phosphide. . . . The existence in solid iron of a definite phosphide of iron, Fe_3P, is well established. . . . . These facts suggest that iron and phosphorus preferentially combine in this particular ratio" (i. e., Fe_3P).

It seems to me from Mr. Knight's remarks on the separation of phosphorus, that he has appreciated but one phase of the question. He puts all the emphasis on specific gravity and hardly touches on the freezing point. The principal cause of the separation or segregation of phosphorus is not found in the specific gravity of its compound with iron, but in the greatly reduced freezing point of such compound.

Steel will be molten in the open hearth or crucible process with no noticeable segregation of phosphorus, but the moment it is poured into molds, the component having the highest freezing point (the metallic iron) tends to crystallize out and to drive the more fusible components in toward the last freezing point. The specific gravity of this more fusible component (Fe_3P) is such that it assists this separation and has its share in determining where the last freezing place will be; but the moving cause of the segregation is the difference in freezing points.

There seems no reason to believe that what is true in this respect for steel will not be equally true for cast iron. Indeed, the last solidifying portions of cast iron have been found to be abnormally high in phosphorus.

R. S. M.

Milwaukee, Wis.

Editor The Foundry:

If the improvement in an industry may be measured by the improvement in the character of the literature relating to it, then the foundry practice of this generation has improved vastly over any similar period in the history of the business.

When, in 1882, Thos. D. West gave to the foundry trade his "American Foundry Practice," it was so far superior to anything that

had been written upon the subject, that it at once took the front rank as the best work on the subject then in existence.

In 1885 it was followed by "The Molders' Text Book" by the same auothr, in which he gave to the foundrymen the first practical work on American cupola practice. There is not the slightest doubt that much of the improvement which has since resulted in methods of melting iron in the cupola is due to the prominence given to that subject by Mr. West, and the interesting manner in which he presented to the trade for the first time the cupola practice of many prominent foundries in all parts of the country.

Although Mr. West was practically the first in the field, and there have been several admirable works on foundry practice written since his first work appeared, he still retains his hold upon confidence of the practical foundry men of this country, and many a molder's trade library consists solely of two well-thumbed volumes of "Tom West's book."

His latest work, "Metallurgy of Cast Iron," which has just emerged from the press, is a fitting sequel to his earlier works, and gives to the practical foundryman, in a concise and attractive form, the results of his observations and practical experience in the work of adapting to the needs of the foundry, in everyday practice, the information gained through the chemical analysis of iron.

No other subject connected with American foundry practice is attracting so much attention at the present time, and certainly no other improvement in the average foundry practice promises so many advantages to the foundryman, when theoretical knowledge is reduced to practical experience.

Mr. West, in his presentation of this subject, has placed before his readers in a plain, practical manner, a study of the blast furnace, together with the methods of operating, chemical changes, and other phenomena occurring in everyday practice, a knowledge of which is of such importance to the practical foundryman, in helping him to a better understanding of the causes which lead to the many puzzling changes which occur in ordinary cupola practice.

Ignorance of the cause of these changes often leads the founder to attribute to the character of his stock troubles which arise from faulty methods of melting.

A thorough understanding of the theoretical side of the subject is not easily gained by the practical melter, and but for such works as Mr. West's, would be a formidable undertaking for one whose early educational advantages had been few.

The appearance of Mr. West's "Metallurgy of Cast Iron" at this time is most opportune, and it is safe to predict that it will surpass his earlier works in interest to the foundry trade, and as the value of his work comes to be better understood, it will bear the same relation to the advancement of American foundry practice that the works of Sir I. L. Bell, Henry M. Howe and Thomas Turner bear to the improvement in the manufacture of steel.

JAMES A. BECKETT.

Hoosick Falls, N. Y.

Fire Fiend.

The Dearborn Foundry Co., of 1532 State street, Chicago, suffered from a small blaze on March 9th.

The Ohio Foundry Company, of Toledo, O., was visited by fire March 16. Damage covered by insurance.

The foundry of John Algeo, Simcoe, Ontario, was totally destroyed by fire. Loss, $5,000; no insurance.

The Perkins Foundry Co., of Amsterdam, N. Y., had its plant damaged by a recent fire. Loss about $600. Insured.

The foundry of the Livingston Manor Mnfg. Co., at Livingston Manor, N. Y., was burned to the ground on March 16.

There was a small blaze at the Ohio Brass Works Foundry, Mansfield, O., March 10. A defective flue was the cause of the fire.

The iron foundry owned by Barney Romaine, on Bridge street, Hackensack, N. J., was burned on March 11th. The loss is about $3,000, covered by insurance.

An overheated smokestack set fire to the F. C. Austin Foundry, Carpenter street and Austin avenue, Chicago, March 14, but the flames were discovered in time to prevent any great loss.

Wooley's Foundry and Machine Works at Anderson, Ind., which but a short time ago suffered from an extensive fire, was again partially destroyed on March 22. Extent of damage unknown.

The large plant of the Weston Engine Company at Painted Post, N. Y., had a narrow escape from total destruction by fire lately. By prompt work the blaze, which started from a core oven in the foundry, was confined, and the damage amounted to but a few hundred dollars.

Fire did a damage of $2,500 to the Brainard Foundry, on Business street, Hyde Park, Mass. The fire started at the base of the stack, near the furnaces, and before it was extinguished, burned through the roof and did considerable injury to the engine room adjoining. The loss is covered by insurance.

The Jenney Electric Motor Works at Indianapolis, Ind., were entirely destroyed by fire March 12. The company manufactured electric motors. The loss is $80,000 to $85,000, including building, machinery and patterns. The total insurance amounts to about $35,000. It is thought the fire was started by electric wires.

There was a lively blaze in the iron foundry of Smith & Leavitt, 125 and 127 Albany street, Boston, Mass., on March 3d. Some varnish stored in the rear basement of the building caught fire, and for nearly an hour the fire burned briskly. The loss is estimated at $1,500. The building is owned by the J. W. Brown estate. The fire was caused accidentally by one of the employes. He was coming downstairs with a light in his hand when he tripped and fell. The light flew out of his hand and landed in a barrel of varnish, which was stored in the basement.

The large foundry of the Farrell & Rempe Company, Carroll and Sacramento avenues, Chicago, Ill., was half consumed by fire on March 4th. The fire started on the roof, and it is thought was caused by a spark from a passing locomotive. It damaged the building, stock and machinery to the extent of $50,000, on which was $45,000 insurance. The building is a story and a half brick structure, 150x225 feet in size, and extends from the Northwestern Railroad tracks to Carroll avenue. The concern is engaged in the manufacture of cold storage supplies and ice machinery.

L. C. Jewett, lately superintendent for the Brockton (Mass.) Iron & Brass Foundry Co., has purchased a half interest in a brass foundry at Boston, Mass.

CAST IRON NOTES.

Devoted to Inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

Preventing Spongy Spots in Castings.

Can you help us to produce solid castings? We understand that you have helped others by advising the use of cast iron borings charged along with the iron. How are they used and in what proportions?

Answer.—This was not an original idea with me. Several years ago I was passing through a large machine shop and came to a row of gear cutters. Some of the gears were quite large and the man who was showing me through the works made the remark: "Awhile ago we had great trouble with this class of castings. We would often set the machine on a gear and each tooth would be sound until perhaps the very last, which would open up a shrink hole, causing all of the work to be lost. We have hit on a way of closing the grain which insures perfect castings every time.

The trouble occurred where the arms join the rim. A spongy hole was very likely to form in one of these places. A gentleman who was with me asked how the defect was prevented, and was answered that it was one of the secrets by which the company was able to succeed better than some of its neighbors. Within a few hours I was in a neighboring foundry and was admiring the fine green sand molds for very large work and came across a large pile of gears very much like those I had a short time before seen in the process of having their teeth cut. I very cautiously asked if they had trouble with spongy spots where the arm joined the rim. The answer was no, but those we are making for our neighbors who happened to receive a larger order than they could get out in their own foundry. We often help each other out in this way. After we had gone far enough for him to forget our conversation about gears, and were near the cupola, I asked if he had any special method for closing the grain in his castings. He took me to see some very large finished work, some bed plates for government lathes which were forty feet long without a single flaw. The grain of each piece seemed perfectly uniform and sound, yet soft and strong.

When he got ready, he said, I will show you how we close the grain in our castings, and we went toward the cupola. I might as well say that this was Mr. W. H. Derbyshire, superintendent for Messrs. Bement, Miles & Co., of Philadelphia, for I am simply passing along information that he gave me permission to use for the benefit of others. He made boxes of cheap 1 in. pine six inches deep, which would hold 100 pounds of cast iron borings. Each time the shop was cleaned the steel borings were separated from those of cast iron and each was put into separate boxes. When full a cover was nailed on. A large number of these boxes were piled in a dry place. In making up a charge, use 100 pounds of borings to each 2,000 of other iron, whether scrap or pig. More borings will make the grain finer still.

This method gets rid of the borings and closes the grain of castings, which is a great gain. A few days later, as I entered another foundry, the foreman called out: "See here, if you can help us; we have tried every kind of iron we have in the yard and cannot get a solid casting." I described the use of borings and planer chips. When I got home I found a letter saying that they would not be willing to try the chips unless I could first explain the chemical action and give a reason for the result. Of course, I had to say that I didn't know any scientific reason, but that the result seemed desirable. The wooden box descends along with the rest of the charge until it reaches the melting point. Above this there is no free oxygen and the box cannot burn but is turned into charcoal. As it reaches the melting point, the air from the blast burns through the box and melts the borings, with hardly any loss. Wooden boxes are cheaper than iron boxes and give better results.

If a large quantity of shot iron or borings have accumulated and it is desirable to turn them into pig iron, check down the blast just before the bottom is dropped and shovel in the small iron, which will be melted with small loss and can be run into pig. It will be found to be as good as any other metal.

Steel chips should be used carefully, generally 100 pounds of chips to 2,000 pounds of other iron and so up to 500 pounds, will materially increase strength, but should not be used continuously as the cast iron boring may be.

If founders would tell in THE FOUNDRY how they produce a close uniform grain and prevent spongy spots and tell of any special methods, they would, in my opinion, treat of the most important subject connected with iron founding.

Next month I will give the chemical and physical results of a test of some test bars lately sent me, which, so far as I know, are the strongest yet reported, and yet the founder does not seem to have any special methods.

Questions and Answers.

O. & Co. write: Can you give us any information in regard to a compound for blowing or sifting on brass molds, to burn off, thus skin drying the same?

(Gasoline is used for this purpose, though it is hardly to be recommended, since it does not all burn away, but partly remains, forming a vapor or gas after the mold is closed, that is sometimes exploded with considerable force when the hot metal enters the mold. This may, to a great extent, be prevented by holding a hot skimmer over the gate immediately before pouring, when the gas will be liberated with less force than if allowed to remain until it came in contact with the hot metal in the interior of the mold.

If any of our readers know of anything else, that would be likely to give satisfaction in quickly and cheaply skin drying molds, we shall be glad to publish a description thereof.—Ed.)

Editor The Foundry:

A correspondent asks in the March FOUNDRY how to cast brass on iron successfully; says he had trouble, etc.

How to do it: Drill intersecting holes in the iron casting where brass is to be added, free the casting from rust or other dirt, mold it in a flask in green sand, heat the iron by applying red-hot iron to the spot, have the brass good and hot, pour fast, and the thing is done, and perfectly every time. I have done this thing so many times that I do not have to guess at the results. Of course, I might give elaborate details, but your correspondent's intelligence will supply these. The thing is: have everything clean, everything hot, and pour fast. Heat and cold op-

pose each other; they always fight when they meet. Even in chilling castings the cinil must be hot to produce good results.

E. H. PUTNAM.

Chattanooga, Tenn.

Editor The Foundry:

It has been very interesting to me, reading Mr. J. G. R.'s articles regarding experiments made with his large cupola. I think from what he has accomplished he has done a great deal toward the advancement of the cupola practice. I should like to ask the gentleman what advantage it is, having the slag holes and tuyeres such a distance from the bottom? I think it necessitates the consumption of a greater amount of fuel than if they were lower; also how many tuyeres has he in each row? As I do not understand about his fixing the cupola for the night, I should like to ask, if after the iron and slag have been drawn off, the breasts cut out, the slag and cinders punched away from the tuyeres, if by the addition of the usual amount of fuel, will this burn away the accumulations in front of the tuyeres, which we cannot reach from the outside? Hoping I have not been too inquisitive, I will explain the way we dispose of our shot iron, namely: Our gangway scrap is screened, a certain amount of which is put in each car of scrap before going on the scaffold. We mill our cupola dump and to accelerate this we place two pieces of pig iron in each mill to grind all the slag. We generally use from 100 to 200 pounds a charge, as occasion requires. It is spread directly on top of our limestone, which is put on the last of each charge, the larger part of which is thrown near the center of the cupola.

J. F. M., Jr.

C. P. F. writes:

In a foundry under my care we make a specialty of fine soft gray iron castings; we run off from 3,500 to 4,000 pounds each cast, using a mixture of four brands of pig iron. Our trouble has been we would get some castings hard, some soft, the iron not seeming to mix in the cupola; we have overcome this difficulty by breaking all the pigs into short pieces and seeing that it is well mixed as it is put into the cupola. The only way we have to break it is with a heavy sledge, which, of course, is an expensive method and involves hard work for the melter.

I should like to ask through your journal if there is an easier and less expensive way of breaking up pig iron. Perhaps some of our foundry friends would not mind giving us some pointers from their own experience.

I should like to know what is wrong with the furnace men; they seem to think any size or shaped block of wood is good enough for a pig iron pattern. They should use uniform medium-sized patterns, so that the iron could be handled and broke with better success. The writer was once employed at a blast furnace where the patterns for the pigs and sows were made to uniform standard sizes; the iron from that furnace could be piled almost as neat as a stack of bricks. Why it is not so now perhaps the furnace men will tell us through your columns, and if they will give us something like a uniform size of pigs instead of the uneven stock most of them are putting on the market, I am sure the foundrymen will appreciate their effort. I think it can be done without extra cost, it is a matter of supervision; just see that the furnacekeeper turns out iron fit to be seen and handled as well as melted.

W. B. N. asks:

Having an unlimited supply of good coal, I wish to use the same in place of oil fuel, as at present, for annealing cast iron. Would any reader kindly give sketch and sizes for furnace to anneal from two to three tons at one time, and oblige.

Among the Foundries.

Harry C. Heermans has purchased the foundry business of Preston & Heermans in Corning, N. Y.

Morrow & Bro. will operate a foundry in Newport News, Va. The shop is expected to be completed by April 1.

Charles Johnson has resigned his position as superintendent of the Howe Scale Company, of Rutland, Vt., and accepted a similar position with The Baush & Harris Machine Tool Co., of Brightwood, Mass.

C. M. Converse, who has lately acquired a large interest in the Holland Radiator Co., of Bremen, Ind., was elected vice-president of that company recently. Mr. Converse has been prominently connected with the manufacture of radiators for a number of years, his latest position being as manager for the Kalamazoo (Mich.) Radiator Co.

The United States Radiator Co., at West Newton, Pa., are erecting a large warehouse.

It is reported that the Temple Iron Foundry Co. will move its plant from Temple to Taylor, Tex.

The Walker & Pratt Mfg. Co. is constructing a new plant at Watertown, Mass. The foundry will be 175x120 feet.

Orren C. Trask, of Holyoke, Mass., has assumed his old position as foreman in the foundry of the Ames Mfg. Co.

The Belknap Mfg. Co., of Bridgeport, Conn., will locate at Warren, Mass. A new building to be used for a foundry will be erected.

William H. and Arthur Pugh have sold their half interest in the Racine Malleable & Wrought Iron Company's plant, at Racine, Wis., to John Davies, who becomes the sole owner and proprietor.

Mr. Daniel Lynch, who for the past two years has been foreman of the foundry at Montello, Mass., which is closing up its business there, has accepted a position in East Bridgewater, Mass.

Thos. Jamieson, Arch., 2529 Continental street, Philadelphia, Pa., is reported to be receiving bids for erecting a foundry for the Fairmont Steel Co. The structure will be of brick and iron and 76x96 feet.

Puddock & Lermont, who recently organized the Sand Beach Iron Works, at Sand Beach, Mich., have just completed extensive alterations in their plant. George Lester will have charge of the foundry department.

The South Pittsburg Stove & Foundry Co. has been incorporated by T. G. Garrett, W. C. Houston, J. G. Pridgmore, R. E. Brittain and W. H. Gurney. The company will put in operation the plant at South Pittsburg, Tenn.

The Indiana Steel Casting Co., Montpelier, Ind., has completed its works, and the furnaces and machinery have been tested and found to work satisfactorily. The company is now in position to accept business and to execute orders for any size or kind of open-hearth steel castings. Within a short time the company will be able to make crucible castings, as plans are now being made for the addition of a crucible plant to the works.

L. L. Graves, of Streator, Ill., is improving and remodeling his foundry, and will install new machinery.

Henry Roos Foundry Co. has been incorporated at Chicago; capital stock, $20,000; incorporators, Henry Ross, Matthias Hand, Louis Baumgartner.

J. B. Ersam & Sons, of Enterprise, Kan., are having constructed two buildings, one 140x40 feet, and the other 100x60 feet, for their machine shops and foundry.

The O'Mara Foundry & Machine Company has been incorporated at Savannah, Ga., with a capital stock of $5,000, by Michael O'Mara, F. H. Clark and R. G. Stevens.

The Allengham Stove Works have been incorporated at Chicago to manufacture stoves; incorporators, James Allengham, Sherman Barber, Mary E. Barber, Hiram Barber.

Weidig & Co., of Zanesville, Ohio, will shortly erect a building suitable for their foundry business. The building will be 30x100 feet in its dimensions and will be conveniently arranged.

The Robinson-Wiggs Foundry & Machine Co. has been incorporated at Birmingham, Ala., by W. G. Robinson, J. A. Wiggs, Jr., and others. The capital stock is $10,000.

The Leechburg Foundry & Machine Co., at Leechburg, Pa., are building a $50,000 addition to their plant at that place. The increase in their orders for rolls necessitated the improvement.

The new plant of the Chattanooga Pipe & Foundry Company, at Chattanooga, Tenn., is said to be about completed, and operations will begin there in a short time. It is referred to as one of the most complete and best equipped cast iron pipe plants in the world.

The co-partnership theretofore existing between E. T. Graham and T. M. Boggs, under the style and title of the Graham Foundry & Machine Company, of Monongahela City, has been dissolved by mutual consent, T. M. Boggs having purchased E. T. Graham's entire interest.

A new structure is being erected at Decatur, Ill., which will be occupied by Pohl & Beatty's foundry.

The Perry Manufacturing Co., at Mansfield, Ill., composed of Freeman and James Hill and Frank Stoner, are building a foundry for the purpose of manufacturing their own castings.

The Star Foundry, of Worcester, Mass., has passed under the control of the Compton & Knowles Loom Works Co., and will hereafter be confined to the work of that company instead of engaging in general jobbing as heretofore.

Maher & Flockhart, of Newark, N. J., whose plant was recently damaged by fire, advise us that the loss instead of being $7,500 with no insurance was less than $3,000 and fully insured. They are now replacing it with a brick building 32x72 feet.

The Dandy Wire Cutter.

Among the many small items that silently enter the expense account of a foundry, the time occupied in cutting wires for cores is generally credited under the head of "Miscellaneous Expenses," and is for that reason but seldom known in its true magnitude. It is commonly cut and try until the wire is made a little short and the result is unsatisfactory. The cutter illustrated here is provided with an adjustable gauge by which

wires of equal length may be duplicated at a very rapid rate. Any size wire up to and including ¼-in. in diameter can be handled.

To overcome the fault, so often found in wire cutters, of the cutting part wearing away in a short time, the best tool steel has been employed in constructing this machine, and the makers offer to refund the price of cutter if not found as represented. It is sold for $5.00. The Robbins & Myers Co. of Springfield, Ohio, are the manufacturers.

The Kilbourne & Jacobs Mnfg. Co., of Columbus, Ohio, has just issued two artistic catalogues, Nos. 27 and 28. Among the many appliances described are their core oven cars, made with anti-friction bearings, doing away with much needless labor, and wheelbarrows of the best construction to suit the different uses to which these are put in the foundry. Copies of these catalogues can be had upon application.

The name of the old house of J. W. Paxson & Co., established in 1855, has been changed to J. W. Paxson Co., incorporated under the laws of the State of Pennsylvania, which will look after the manufacturing of foundry facing and supplies with a capital of $450,000; and Lumberton Sand Co., chartered under the laws of New Jersey, which will attend to their molding sand interest in that State, with a capital of $150,000. The new officers are J. K. Bougher, president; Howard Evans, vice-president; H. M. Bougher, secretary; Wm. W. Wood, treasurer. Mr. Paxson is still with the firm and holds a large block of stock, but would not accept any office as he has retired from active business.

Taylor, Wilson & Co., Ltd., of Pittsburg, Pa., have issued a neat pamphlet called "Data on Machine Molded Gears." For some time past this firm has been filling large orders for gears, produced by the Groves patent molding machine, and this little book has been compiled in order to facilitate answering the numerous inquiries they have received in regard to further information upon this subject. The advantages of a gear having the teeth molded and cast over those produced by much expensive machine work has been fully demonstrated in previous issues of THE FOUNDRY. The book gives much interesting information, particularly valuable to users of gears, and forms a handbook that will prove of great help in selecting the most suitable gears, the calculation of which is, to the average person, attended with more or less mental exertion.

NOTICE!

Advertisements in this column, 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than the 1st of the month to insure publication.

Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, we will give one free insertion under this heading to those in want of positions, the advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

WANTED—Foundry Crane, from 3 to 8 tons capacity. Must be cheap or a bargain. St. Cloud Iron Works, St. Cloud, Minn.

WANTED—Experienced foundry foreman. One who understands making of hollow ware and other castings. Address Box 25, care THE FOUNDRY.

FOR SALE—No. 3 Root blower, used only few months; to be replaced with largest size. Address Box 4, care THE FOUNDRY PUBLISHING CO.

FOR SALE—No. 11½ Buffalo Blower, little used and in perfect condition; will sell cheap. Address Kings County Iron Foundry, No. 86 12th st., Brooklyn, N. Y.

WANTED—Copies of THE FOUNDRY for January, 1893, and November, 1894. Will pay 25 cents for each. Address T. F. F., care THE FOUNDRY PUBLISHING CO.

WANTED—An experienced foundry foreman with $2,000 to invest in the business. Only those of good moral character wanted. Address, giving references, Box 37, care THE FOUNDRY.

WANTED—Position as foreman in foundry on bench work; can also do floor work; 15 years' experience, 5 as foreman in snap shop. Best of reference. Address Box 67, care FOUNDRY PUBLISHING CO.

SITUATION WANTED—As foundry foreman by young man, thorough mechanic, intelligent, and of good moral habits; understands his business; can furnish reference. Address Box 70, care THE FOUNDRY.

WANTED—Position by young man with 8 years' experience in green and dry sand molding. Accustomed to work with sweeps. Reference from present employer as to sobriety and capability. Address Box 68, care THE FOUNDRY.

WANTED—A good, practical machine and jobbing molder, with some capital to invest in well established foundry, machine and manufacturing business and take permanent position at good salary. Address Box 66, care THE FOUNDRY.

WANTED—Position as foreman, 20 years' experience on chilled rolls, dry sand, heavy and light green sand; thoroughly understand the melting and mixing of iron for all kinds of work; good references given. Address Box 6, care of THE FOUNDRY.

SITUATION WANTED—By a thoroughly competent man, both as a mechanic and manager, to assume charge of foundry plant, proficient in economical production. Has experience. Can furnish reference. Address Box 58, care THE FOUNDRY.

LIVE FOUNDRYMEN, ATTENTION!—I want to make a change if I can find the right party. Competent to fill any position in foundry life and have the experience; you needn't pay for experiments. Best reference. Life is too short to waste, hence only those really wanting a man of energy to conduct their business, please address Box 27, care THE FOUNDRY.

WANTED—Situation as foundry foreman by one who has had ten years' experience as foreman on all classes of work. Thoroughly capable of handling a foundry in all its details. Can manage men to the best advantage and understands the melting and mixing of iron to obtain different qualities. Can give the best of references as to character and ability. Address Box 53, THE FOUNDRY.

WANTED—Position as superintendent or assistant of manufacturing company, by a practical manager, who is a first-class machinist and foundryman; thoroughly experienced in the melting and mixing of metals for iron, steel and bronze castings; also experienced in blacksmith and woodworking work, and able to handle men and work to advantage. Address Box 69, care THE FOUNDRY.

FOR SALE—A complete set of iron patterns for one of the most modern constructed corrugated warm air furnaces on the market, including three sizes. Also a first-

class set of register patterns. Furnace has been on the market five years and has good established trade, which goes with patterns. Price reasonable. Reasons for selling, other business demands our capital and attention. Address Box 48, THE FOUNDRY.

WANTED—Position as Foundry Foreman, by a man experienced as such. Address Box 71, care THE FOUNDRY.

FOR SALE—A small foundry and repair shop, or I would associate with partner acquainted with the manufacture of plows. For further particulars address WILLIAM ENGBRING, Cedarburg, Wis.

FOR SALE—Foundry and machine shop at Mason City, Iowa, fully equipped with machinery and flasks; well established; only plant of the kind in this territory; good reasons for selling. Write for particulars to H. I. PRUSIA, Mason City, Ia.

The Aermotor Co., of Chicago, are sending out a pictorial description of their different products. It tells it own story.

D. June & Co., of Fremont, O., in calling attention to the superior qualities of their engines, have favored us with a neatly gotten-up map of the world.

The Hayden & Derby Mnfg. Co., of 111 Liberty street, New York, are mailing a pamphlet describing the special features of the well-known Metropolitan Injector.

The J. W. Paxson Co. have issued a catalogue describing chaplets repping plates, lifting screws and other improved accessories to a well conducted foundry. Copies can be had for the asking.

To show the extent to which our manufacturers are increasing their foreign trade we may mention the Buffalo Forge Co., as issuing catalogues in various languages, calculated for their patrons outside of the United States. A copy of the Spanish catalogue, intended for Mexico, is now being mailed. The Buffalo Forge Co. says that the foreign field has proven so profitable, even in the old European countries, that they anticipate their export business will soon surpass the home trade.

The Tonawanda Iron & Steel Co., whose agents are Rogers, Brown & Co., have favored us with "A Souvenir of the Lighting of Niagara Furnace." Nothing so artistic in execution has come before us for a long time. It is a pictorial description of the notable event of November 5, 1896, when Mr. McKinley, by the aid of electricity, started the fires from his home at Canton, O., the recollection of which is yet retained by the public.

The views shown take one from the furnace through the plant with its office and laboratory to the final grading of the iron, and when the last leaf is turned one only regrets that there are not more pages of such bright and instructive information.

The P. H. & F. M. Roots Co., of Connersville, Ind., has just completed putting in a steam plant of 200 horse-power capacity and have installed electrical machinery for running their new 10-ton Shaw electric crane in their new erecting department, which measures 185x90 feet. It is claimed that this makes it the largest plant in the world for the manufacture of rotary blowers, pumps and exhausters. It is said that a number of improvements will be added to the plant during the coming season.

The Hot Water Manual has just been published by the American Artisan Press, Chicago, and forms one of a series of similar works. The author, Walter Jones, is a heating apparatus manufacturer. The subject is considered fully, and in a manner adapted to the needs of those who start with little or no information, and the text is amply illustrated. The high, medium and low pressure systems for hot water heating are treated separately, with full information as to the dimensions, construction, arrangement and details of the different apparatus used.

Mr. Theodore H. Colvin, of Providence, R. I., has begun work on his new foundry building. This building will be 102 feet wide and 180 feet long. The central portion, 50 feet wide, will be served with a 20-ton traveling crane, and at distances of about 25 feet in the length of the building will be placed 5-ton jib cranes, swinging from the central portion of the building over the molding floors in the wings, which extend along both sides of the building and are 25 feet wide. The entire framework of this building will be steel, which is being furnished and erected by the Berlin Iron Bridge Co., of East Berlin, Conn.